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SCIENCE & ENGINEERING

Volume XXXI No. 1 January 1978

AN INTELLECTUAL FOOTHOLD

It has been said that the Political freedom of our Country was not appropriately accompanied by the liberation of our minds. Our biggest failure during the last Thirty years was our inability to gain an intellectual foothold of our own.

We have still to discard the 'Value System' that we acquired during the British rule. We respect many of our institutions not for their instrinsic values, but becauses they are Western in Origin. Since the nineteenth Century a view has gained ground that Sciencc is 'modern', its development is modern, and it is Western. No doubt we are mnch indebted to Europe and America for the present Scientific achievement, but we are apt to forget that Science 'per se' is as much Indian, Chinese and Arab as it is European and American.

In the 18th & 19th Centuries our country was subject to the Western impact of culture and Science, to the impact of Engineering on a Scale we probably never experienced earlier. The transition of our Country during the period was accompanied by a social and intellectural ferment. We have gone through an intense political ferment, during the transition from colonialism to freedom, but we have not gone through any such experience in India on any large scale in the field of Scientific achievements during the last thirty years of regaining freedom. On the contrary has been in general a mental and moral inertia along with atrophy of our creative faculties. This has been dur largely to our faulty educational system, nnd absence of a dynamic intelligentia in the Scientific and mathematical fields.

If we look to other countries, we find the Universities there act as brain trusts and fountains of scientific and technslogical and mathamatical ideas. Thousands of young research students there are busy with research project of 'fundamental' nature, as well in areas of technological and mathematical advancement. The universities and colleges there act as living institutions capable or changing the entire life of nation, charging young mihds with the electrifying urge to create and inspiring them to think anew from fresh angles. The teachers and professors there are epitomes of learning, venerable,

dynamic, cultured and scientifically minded, Science and methematics have equal hold there with philosophy. Their dynamism electrify the students urge the students to areas of discovery and invention, Politics is far away from the precints of the University campuses. In our Country the Universities are hot beds of politics. They are made of brick and mortors, not of venerable fountain heads of learning. The Universities here are · mere 'examining bodies' without mind or any electrifying effect on students. Our Universities issue degrees as platform tickets, are issued by a slot machine. The way they are how moving in the field of study, it is doubtful if they will ever acquire the level of learning of a Cambridge, a Heidelburg a Sorbonne, or a Harvard. Not one of our Universities have a research department which is known to have done during the last thirty years any significant work in the field of science and learning. Since independence, Universities have no doubt, mushroomed like green grass after the rains, like Chinese Laundries, like Udupi restaurants. They turn out graduates and higher secondaries like 'medu Vadas'. Gone are the days when the Universities turned out a Meghned Saha, a Jnan Ghosh, a Dr. J. C. Bose, a Satyan Bose. Our universities do not attract foreign students in numbers to study here. Those who boast of our heritage do not remember our Nalanda and Takshasila which taught students from all over Asia Now we send our youug men and women abroad for them to do research work in foreign Universities, the young brains to benefit other nations, and to learn how to count.

Our Universities have not now the monumental fountain heads of people who can urge and inspire learning enmasse, no Sri Asutosh Mukherjee, who can attract scholars to Universities, who can make Uuiversities turn out scholars, and scientific and mathematical minds in place of degrees. The object of our Universities now is not to promote independent and creative thinking. They do not even effectlvely teach a craft or a skill creative thinking, development of ability for expressing creative thoughts, a mathematical and philosophical base of our leaaning are surprisingly absent. Our colleges and universities now do not turn out scholars, masters of thought and exprience, but only clerks for the Govt. and commercial offices and even then they are poor in mathematics, in Science and in expression of languages.

In fact we have to find out why we send our children to Schools and Colleges. It is sad to .see year after year scramble for seats in commerce, engineering & medical eolleges. The only question in mind is best expressed in Tamil 'Soru Poduma' (will it give rice ?) No doubt rice is required in life to keep the body going, but that above is not the end of life. Though it is a lagitimate question, in other countries not only 'Soru' is asured but also a higher quality of life. In India let alone Science and Culture, there is not even the minimum guarantee of 'Soru' or rice.

Eeonomics, Sociology, anthropology, history, linguistics, Philosopy, psychology, eqally important as Science, Engineering & Technology all these are subjects of great relevance to growing nations. Mathemattcs is ·another. India is going to pay dearly

for the neglect of mathamatics and English. Everything is getting mathematicised these days, and future civilisation, experts say, wlll be determined by mathematical concepts.. Our average standard in mathamatics is so poor that a so called first class student from any one of Universities is unable to follow lessons in institutions abroad.

We take pride in the fact that we are already technologically advanced. We work on blueprints of other nations. We have yet to develop our own blue prints, our own knowhow. Our Scientist and Technologists are not inspired to great works, to 'dedicated works'. Our national Laboratories are fully equipped but the volume of significant work by us is suprisingly small. Since Dr. J.C. Bose's works on plant life early in the century, and Dr. C.V.Raman's works on 'Raman effect' early in 1930, and Meghnad Saha's work on 'cloud chamber' and S.N. Bose's work on 'nuclear spin' very little fundamental work has been done in Science and mathamatics.

Our Scientists have talents, but no genuis now a days. Dr. Homi Bhaba deteriorated to 'Scientific Statesmen', Dr. K. S. Krishanan withered away due to shear laziness, Dr. Jayant Nerliker who collaborated with Fred Hoyle, with Hoyle-Nerliker theory on Cosomos, has also not fulfiled his early promise.

Is it due to some cultural factor, or as Sociologists say, due to lack of motivation, or is there something worng with our management of Science and mathamatics ?

It appears we Indians are physically lethargetic, intellectully indolent, where fundamentals are concerned. We are vociferous and ferocious in Politics, we love to dribble with money where is available, but with fundamentals of Science and mathematics we are shy, and yet over a thousand years ago we were neither shy with mathematics nor with scientific fundamental thoughts.

There can be no advancement for the nation—cultural or economic or Scientific, without Science and mathematics both in Nation's life.

Wishing you a Happy New Year
Editor
SCIENCE & ENGINEERING

"Lure of The City"

By

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The 80% of World's population will be living in the cities by another quarter century. Even in the country like India, where more than three fourth population lives in the rural areas, people will shift upto the extent of 50% i.e. half the population will lodge in the urban areas. This will create enormous pressure on existing towns and those now being developed.

Practically in all parts of the World, urban population is increasing much more rapidly than rural, because of increasing migration from the country to the towns. Many major cities of the world have doubled in population during the last one decade. The consequences of un-controlled migration to the cities include physical, and mental diseases, mal-nutrition, poor social conditions, inadequate and sub-standard housing and at large un-satisfactory enviromental conditions.

The world is raising with fast alarm. In cities like New York, Paris, London, and Tokyo, more than half of the absorbed oxygen is consumed by automobile engines, says the French Weekly "Litteraire". Are not we being chocked by our own wastes. Asks the West German magazine "Sterm". In Tokyo, within one year the smug alarm was announced 154 times.

In Rohr, which occupies the 12th position in the world by way of population density, every year 1300 people die in car accidents and nearly 12,000 are crippled.

Numerous physicians think that the fast tempo of life in a big modern city is too much for man's nervous system, Still people are eagar to move to the city and the cities themselves continue to grow. It is therefore assumed that population of greater Calcutta may reach some-where between 56 millions to 66 millions by the year 2000. Even today, the city is in an extreme state of congestion, with 79% of Calcutta's families are are occyping single room or far less accomodation, while in certain districts, 32 to 50 persons share a single latrine. The plight of slum dwellers is awfully worst.

Transport is becoming increasingly logged down and despite the high population density, people must travel constantly greater distance from home to emplopment. In some of African countries, only 6% of houses have indoor piped running water. There are no public sewerage system. Most homes have only an open hole for their latrine. Migrants to the city are generally young people, the majority of whom are un-skilled, impoverished and mostly illeterate or semi-educated. Once they arrive

they are no longer subject to family or tribal protection and restrictions and are thus bewildered by a changed environment and exposed to new temptations. It has created delinquency, drug addiction, alcholism, prostitution, veneral diseases, crime and anti-social behaviour.

The lure of the city is so strong that it cannot be overcome by laws, regulations or Acts.

Also, in developed countries, the problems are on the whole somewhat different, but hopelessly grave. In Czechoslovikia, the effect of urban air pollution was very discouraging. Studies in Britan indicate that 2-3rd of infant deaths could be prevented by improvements of a limited number of factories, as 1/3rd of these preventable deaths were associated with overcrowding, 1/4th low paid occupation, 1/5th with unemployment and 1/8th with industrial employment of women. It is the position of very advanced country. The plight of the over crowded cities can be well imagined.

Many of the reports revealed in documents including those from the Soviet Uuion, U.S.A., Sweden, Yogoslavia and France stressed the importance of "Green Belts" around cities and cite the danger arising from prolonged period of intensed atmosphere, pollution, as have occured in London, New York, Los Angeles, Denora, Pensylvania and elsewhere. The gardens are the lungs of the city. Therefore maximum number of those should be provided in urban area.

Newzealand suggests that future air pollution problems from fossil fuels (mainly coal and oil could be avoided by moving more rapidly to nuclear power generation and by developing and utilizing advanced techniques for recovering valuable sulphur from fuels, thereby reducing air polution by sulphur dioxide.

Urban Fringe

Some middle and lower middle class families also move to the urban fringe or even further into surrounding area, where land costs are lower. Such suburban areas often do not have municipal sewers, water pipes and refuse collection services or other infra-structure amenities, which ultimately threaten to degenerate into unwhole-some slums in due course.

In some countries, a determined effort is made to limit the size of city. In Czechoslovakia, without any drastic measure, but by using regional planning, as well as economic and administrative intervention, it has been possible to keep the population of Prague almost stable for the last thirty years. In Venezuela, the Ministry of Public Health Incorporation with the National Agrarian Institute and Agricultural Bank, have had so much success in building planned village and aiding agricultural workers to earn a better living. It is therefore recommended restructuring of villages into new "Viable units" for effective implementation of the programmes for integrated rural development.

The viable villages could be formed by grouping clusters of them with necessary social, economic and resources links and establishing necessary transport facilities, so that each cluster forming a new village could function as one integrated unit The enlargement would ultimately bring

within the scope education, health, co-operation, Panchayats other developmental and welfare services, as well as use of science and technology for improvement of equipment and skills in rurul population.

The most important and imparative task is the family Planning, which falls into the category of Public Health measures and that without it, many other public Health measures can never be more than palliative since the enormity of task at hand will be more than the Government can cope with.

The Measures to Check Migration

1. In any big city any further growth of large scale manufacturing or industrial activities ought to be prohibited.
2. No large scale expansion of State Government activity should be permitted within urban area. If such activities are to be enlarged, they must go the adjacent towns, and rural areas.
3. Adequate investment in urban infrastructure should be provided in the adjacent small and medium sized towns, which could absorb much larger population.
4. Larger urban centres located at a distance of 50 to 90 kilo meters should be suitably planned for a faster growth.
5. Those satelite towns must be connected with fast running regular serviced trains after short intervals, Air Buses and air taxies, as well as other automobile vehicles, with swift and quick communication system
6. Regional independent industrial centres should be developed rapidly, so that they could effectively and efficiently check increases of population of metropolitan other cities.
7. The efforts should be made towards a rapid rural development based on the scientific utilisation of national resources including the natural and human services.
8. The dire need is for planned reclustering of jobs, services and amenities based on the agro-ecological potential and socio-economic needs of each area, as a measure to arrest the migration of the rural educated to the cities and for the overall development of the country side.

Pattern for New City

It must play a significant role in the evolution of modern architecture and human environment as a whole. It should provoke a fresh thinking and also in fact to show a new way of life for the benefit of the common man.

As most of the population still live in villages, therefore during the process of urbanisation, when they move to the city, it is entirely a new experience for them. It is therefore of utmost importance to provide a way of life in the cities, which ought not to be completely alien to the villagers Their traditions and habits must be respected while giving a modern form to their living.

The new city should be divided into suitable independent sectors, which is essential for the core of any Master Plan to develop the same. Each sector should have its

maintenance organisation, the food provision, the schools, shopping centres, with large emporium, post office, police station, petrol pumps, dispensaries, cinema and theatres, banks, ·holy shrines, play ground, garden, swiming pools, Sewers, water pipes with fire hydrants, metalled roads, telephone lines, amenities of other necessary artisans all located in the middle of each sector. Every sector must be surrounded by high speed roads with bus stops and provision of taxies.

If possible, there must be a .Museum and Art gallery in one of the sectors, which must house innumerable paintings and sculptures, both traditional and contemporary.

If funds permit, there may be a zoo and lake with rowing and paddle boat available on hire. The bank of the lake shall serve walk-way to the strollers of all ages. Similarly, Rose Garden may be established in some other sector to attract the visitors The colleges, Government buildings like courts, hospitals, mini secretariat, municipal offices, circuit house, etc. may be built in some other sectors. In short, the orderly structures with their well designed landscape composing beautiful laid parks, gardens, open space, shady ornamental and blossoming trees make the city specially attractive.

Le. Corbusier's concept of Chandigarh envisaged its development as predominantly administrative, cultural and educational city offering all amenities of life to the various sections of its population including the poorest of the poor. It was based on a very imaginative area planning keeping in view the climatic conditions, habits of the people and the human and material resources. The concept of neighbour-hood living, the classification of roads, the zoning plans and the architectural controls were clearly defined to shape the large concept of the city as a living, throbbing viable organic body. The Master Plan was an effort at co-ordinated development as an attempt to take account of the imparative factors of ecology, so that living and working could be carried on in the most congenial environments.

In new cities, all building materials for construction should be made easily available to the general public at the controlled rates. The new structures should also be exempted from the house tax at least for one decade to encourage the wave of investment in the building industry. There should be no shortage of essential commodities and supply of electricity, kerosene oil, diesel, cooking gas, coal, coke etc.

The medium type industries should be set up around the city with subsidy aid to the new enterprises to boost up the economy of the region, as it plays key role to eradicate un-employment. It should be incumbent on the part of industrial employers to built houses for their employees.

Development of Handloom Industries in India

By

RAKESH COOMER, B. A., D H T, LTI

(*Continuation from previous month*)

Arrangement of selling units

Financial assistance is being provided to the Weavers' Co-operative Stores for setting at sales Depots. Loans and grants are also granted by the State Governments. An amount of Rs.,15000/-, Rs. 35,000/- and Rs.65,000/- is granted to A.B.C. type of sales units respectively.

All India Handloom Fabrics Marketing Co-operative Society had laid down the policy of marketing for the products manufactured by the Industrial Weavers' Co-operative Society of India. This organisation is purchasing the products and selling in varions parts of the country as well as abroad through handloom houses. At present, there are 5 handloom houses in India and in abroad.

Rebate

In the year 1953, there was heavy accumulation of handloom clothes. All India Handloom Board devised some methods to regulate the handloom stocks The scheme of rebate on sale of the handloom clothes was introduced. At present, a rebate of 5% on retail sale and 3% on wholesale is allowed by the Central Government and special additional rebate of 10% is allowed on sales for the period of 15 days during All India Handloom week.

Godowns

It is very well known to every body that period between July and September is a period for handloom-trade due to agricultural work and monsoon. In order to maintain the spirit of the weavers and for stocking the products manufactured by various production-units, assistance was given through loans and grants.

Market Study

It is very essential to find out the taste of the customer in various places regarding designs, colours etc. Various surveys have been conducted by All India Handloom Board, Handloom Export Promotion Council, State Governments, Handloom Handicrafts Export Corporation and South India Textile Research Association. Proper Guidance was given to weavers time to time.

Training & Research

On the recommendation of the State Handloom Advisory Committee, the following two Institutes were set up for development of the grade.

(1) Weavers' Service Centres

Weavers' service centres were organised by All India Handloom Board and the main object of such centres is to extend

technical advice regarding problem, loom and past loom. Each weavers' service centre consists of the following:

Design Section

An art studio was established which comprise of artist and the various art-colleges, traditional artists from every state apart from nakashi behind, designers and graph markers.

These artists prepare the designs according to the tastes of consumers of the country and abroad and provide designs to all the weavers on very normal charges.

Dyeing and Weaving section

A fully equipped dye-laboratory with qualified technical staff to provide technical guidance and solve the problems of the weavers from scrowing of yarn to finishing of textiles was set up. Two shade-cards one for cotton and another for silk have been prepared by this laboratory.

Weaving section helps by way of extending guidance (technical as well as general) for the production of new fabrics. and the use of improved looms and appliances.

(2) Indian Institute of Handloom Technology

After feeling the need to gear up the technology and efficiency of the handloom and to provide the necessary supervisory and skilled personnel, Government of India decided to make up the Government Central Weaving Institution Varanasi and Textile Institute Madras now shifted to Selam.

The main object of taking up these two institutions was to cover northern and southern part of the country for training and research work for the development of haddloom trade under the chairmanship of Mrs. Papul Jayakar, Hony. Adviser (Handloom).

Other objectives for the taking up of the said institutions were as follows:

i) to undertake experimental and research programme in all the aspects of handloom industry.

ii) to lay down the highest possible standard of training for the handloom industry and to devise short term and long term training programmes for technical personnel to be employed in textile industries.

iii) to devise channels of service in order to build up a closest possible liaison between the institutes and handloom-production-units.

iv) to see that the outcome of the research conducted by the research section is made available to all the handloom industries.

v) to impart training about practical methods of handloom-weaving, dyeing and pattern-making to the persons employed in the handloom industries.

Two types of training programmes were suggested.

i) A long term course for higher supervisory personnel and textile-designers.

ii) A short term training programme for craftsmen already employed in the industries in order to finalise the new appliances, techniques, designs, colour-harmony etc.

The Institute of Varanasi covers the needs of the states in U.P., M.P., Bihar, West Bengal, Orissa, Assam, Manipur and Tripura while the Salem Institute caters to the needs of Tamil Nadu, Andhra Pradesh, Maharashtra, Karnatak, Kerala, Gujrat and Pondicherry.

Besides this, these institutes trained the persons sponsored by Middle-East, Thailand and Ceylon under Colombo Plan.

The following research work has been performed by these institutes for the development of handloom industries.

i) Clothes' been attachment on Banarasi-loom

With the help of such arrangement on pit-loom, weavers can weave 60 to 80 yards of cloth in comparison to old methods by the help of which only 15 yards of cloth could be woven.

This type of take-up motion attachments are useful for frames-loom and pit-loom and this will improve take-up motion and craftsmanship and avoid irregular picks.

ii) Mosquito Net Jacquard :

To produce figured mosquito-net on handloom, a special kind of loom fitted with jacquard is discovered by this institute.

iii) J-Durre loom

A special cross border jacquard with pick and pick-slay has been divised to manufacture heavy texture pattern on fly shuttle frame loom. The jacquard is worked on special type of paddle for forming the shade.

(*To be continned*)

NOTES & NEWS

Smokeless Domestic Oven Developed

The Central Mechanical Engineering Research Institute, Durgapur has developed a novel smokeless, regenerative, high efficiency domestic oven which has been judged as the best design in an all-India competition recently organised by Coal India Limited. The Institute has been awarded a cash prize of Rs. 5000 for the development.

The oven consists of a cylindrical core chamber with an annular chamber round it. The annular chamber is closed at the bottom and has a removable top cover. During normal cooking, coal fines are kept in the annular chamber which beside providing insulation, acts as a regenerator because it utilizes a portion of the heat energy (which is normally lost in conventional domestic oven) to produce coke for subsequent burning in the core chamber as smokeless fuel. During the process of coke formation, volatile gases are generated in the annular chamber which are burnt either in a separate gas burner or inside the bed. In either case heat utilisation capacity is considenably higher than conventional oven. The burning of the volatile gases is controlled by a valve.

The core chamber is so shaped that it provides an efficient draft. It holds 1.5 kg of coke, while the annular chamber may contain 2 kg. of coal fines.

The ,bare oven weights about 5 kg. Its manufacturing cost is estimated at Rs. 30 Start up time is 18 minutes, duration of useful fire 170 minutes and heat utilisation

capacity is about 50%. Normally, conventional oven of same capacity utilises heat up to 35%, and gives useful fire for about 150 minutes.

Industrial Rubber, Polymers and Waxes Developed

Indian scientists have developed technologies to produce a wide range of industrial rubbers, polymers and waxes which have been imported so far.

Some of these technologies are ready for commercial utilization and promise to save considerable foreign exchange once put to commercial use.

The National Chemical Laboratory, Poona has developed polysulfide rubbers which have outstanding resistance to wear and tear due to fuel, ozone and weather. These rubbers find use in the manufacture of aircraft, marine and automobile Industrise.

Another rubber known as Sulfochlorinated polythylene (SCPE) has been developed at the laboratory with outstanding resistauce to weather and abrasion. It can be used for high temperature gaskets, hoses, shoe soles. Technology for the manufacture of cellulose butyrate (CAB) has also been developed by NCL. It is an essential component for the manufacture of fountian pens. At present, the country's entire requirement of CAB is met through imports. The utilization of this NCL technology will not only save foreign exchange but will also give fillip to fountain pen maunfacture in the country.

In another experiment, the laboratory has successfully produced rigid urethane foam for use in regrigeration, transportation and as a substitute to wood in furniture.

The Indian Inst. of Pertroleum, Dehra Dun has for the first time in the country produced microcrystalline wax for use in eletrical insulation and for paper and leather treatement.

The wax is now being exported by the Oil and Natural Gas Commission. Orders for export of this microwax has been secured from UK, Germany and Japan. The process developed by the IIP scientists makes use of a waste product in the production and pumping of crude oil.

Forthcoming Event

Oceanology International 78, the fourth International Exhibition and Conference for the Offshore Industry, opens at Brighton, England, from March 5-10, 1978.

The 0I Conference will include national progress reports from the leading countries with offshore interests, Major sessions will be held each day. Two full days are devoted to rig and platform development. Other sessions will include the latest development in submersibles, support vessels, diving technology, systems for acquisition and handling of ocean/weather data, instrumentation, deep-sea mineral recovery and marine biology.

The exhibition is officially supported by the British Government. It is ably assisted by the Development Council and by the International Advisory Council from the following countries : Australia, Bulgaria, Canada, people's Republic of China, Denmark, France, Germany, India, Japan, Mexico, Netherlands, New Zealand, Norway, Sweden, UK, USA, and the USSR.

Further details about 0I 78 are available from the organisers, BPS Exhibition Ltd., 4 Seaford Court, 220-222 Great Portland Street, London W1N 5HH, England.

Package deals, from India, are handled by the official travel agents, American Express.

Mystery Planet Venus

Venus is a sister of the Earth. Its mass is only 20% less then our planet's and it is 5% smaller in diameter. Before direct space studies started the scientist believed that the climate on venus differed little from the terrestrial one.

Recently Soviet interplanetary automatic probes were sent to the planet for direct studies of the Venusian atmosphere. There decent modules made a soft landing on the planet's surface and sent a panorama of it back to Earth.

It has been found out that the Venusian atmosphere is composed mainly of carbon dioxide that strongly absorbs infra-red radiation and facilitates the attainment of high temperatures in the atmosphers. Close to the surface they reach 470 to 480 degrees centigrade while pressure is as high as 100 atmospheres.

Due to weak magnetic field, characteristics of the ionosphere is also peculiar. The spectrum of upper atmosphere glow is sharply different from the terrestrial one.

New Electronics Devices

The Central Electronics Engineering Reserch Insitute (CERI), Pilani, has developed a number of new products, e.g. digital sound level meter, electret throat microphone, Piezoelectric ceramic throat microphone, VHF multichannel varicap TV tuner, VHF television sweep generator, and RF induction furnace.

Hari Om Ashram Prerit S.S. Bhatnagar Research Award

The Central Salt & Marine Chemical Research Institute (CSMCRI), Bhavanagar, has invited nominations for the 1976 and 1977 Hari Om Ashram Prerit S. S. Bhntnagar Reseaach Award. The award, institued the board of trustees of the Hari Om Ashra Nadiad, is given every year in rotation to Indian individual/team for his/her/its outstanding original researches in desalinati solar energy for power, and prevention water pollution in India.

The award for the year 1976 will be i 'Solar energy for power'. As the nomination received in response to the earlier invitatio have been found unsuitable, the exper committee has decided to invite fresh nominations for the 1976 award.

The award for the year 1977 will be in 'Prevention of water pollution in India''

Nominations (six copies) for each of the topics separately in the prescribed proforma, with relevant documentary evidence for the consideration of the expert committee, should reach the Director, CSMCRI, on or before 1 January 1978. The regulations governing the award and the prescribed application forms can be had from the Planning Cell. Central Salt & Marine chemicals Research Institute, Bhavnagar 364 002, by sending a self addressed stamped envelope (26.5 cm × 11 cm).

Sonik Shock Guard

Sonik Aids, 52, 7th Cross Road, Bangalore 560003, has developed shock guard for switch off leakage current 4-10 milli ampere adjustable for detection of excessive leakage currents due to wrong wiring or defective eleetric appliance or deterioration of insulation materials. The advantages are it eliminates hazards of eleciricity i.e., electrocution fires due to earth currents, gives a visual indicatian to correct the fault when developed and enables to reduce electric bill. Cost of this device is Rs. 475/-.

SOME HIGHLIGHTS ABOUT I S E

- Incorporated on August 6, 1934, it is in existence for 43 years.
- Its membership is open to Engineers and Industrialists and Technologists, Technicians and Learners alike.
- It now offers membership to respectively qualified persons in seven categories: Fellowship (F.I.S.E.), Membership (M..I.E.), Associate Membership (A.M.I.S.E.), Licentiateship (L.I.S.E.), Associateship (Assoc. I S.E.), Graduateship (Grad. I S.E.), and Studentship (Stud. I.S.E.).
- It has on rolls nearly 4500 members within the country and all over the Globe including Bangla Desh, Burma, Ceylon, Singapore, Malayasia, Middle East and African countries the U.K., U.S.A. and West Germany.
- It publishes a Monthly Journal, "SCIENCE & ENGINEERING", from 1935, commanding a circulation throughout the world.
- It maintains a Library containing above 2,000 volumes of Books and Reports.
- It has published some technical text books bynoted Member-Authors, e.g. "Building Materials", & "Mineralogy, Petrology & Economic Geology" : Tables (an enlarged Third Edition of this latter work i. e. the TABLES has been recently published by the Indian School of Mines & Applied Geology, Dhanbad.)
- It conducted Postal Coaching for sometime, also a Refresher Course for Electrical Supervisor's Certificate examinees.
- Its ambassadorial services embrace Lecture Programmes, Inter-Society collaboration and exchange of ideas, delegation to national and world Engineering Congress.
- It of late has urged and brought to the notice of the Government the need for National Engineering & Technology Policy.
- It acts as a principal sponsor of the Federation of Professional Engineering Institutions of India (F.P.E.I.I.) cum the Joint Indian Engineering Council (J.I.E.C.).
- It of late has set up a BRAIN TRUST along with Technical Information Department to provide aid and guide to Operational Research and Practice in different fields of Engineering and Technology.
- It has on its record the association of eminent personalities like Bharat Ratna V. V. Giri, Late Sir C. V. Raman, Dr. Kailash Nath Katju, Dr. J. C. Ghosh, Nawab Zain Yar Zung Bahadur, Prof. Bhim Chandra Chatterjee, Dr. B. N. Dey, Air Vice-Marshal Harjinder Singh, Dr. J. N. Basu and Engineer - Administrators like Dr. K. L. Rao, Dr. T. Sen, Sri T. R. Gupta, Sri P. C. Bose, Sri P. C. Mitra, Sri S. S. Mukherjee, Dr. K. R. Chakravorty, Sri U. P. Mullick, Sri N. Chowdhuri, Sri H. D. Bhowmick, Sri N. N. Chakrabarti, Dr. H. N. Sethna, Dr. R. Ramanna, Sri S. Samaddar and of leading industrialists like Late Shri R. L. Kirloskar of Yantrapur, Mysore, and Shri G.D. Naidu of Coimbatore.

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SCIENCE & ENGINEERING

Volume XXXI No. 2 February 1978

RIGHT OF HOUSING ACCOMODATION

In our country where 90% of o population are under poverty line, who do not have enough food even for one meal a day, it is a visionary object for them to live in a house. But housing is no less important than food or clothes.

For the past few years the land value in the cities and metropolitan districts has gone up sharply and except for a few fortunate it is practically impossible for the common people to acquire a plot of land for dwelling purposes. Not to speak of private land even the price of the land developed by the government agency at Salt Lake has been doubled in Sector II in course of 8 to 10 years. Originally Salt Lake City was planned by Late Dr. B. C. Roy for the habitation of the middle and low income group people, and the idea was that no one would be allowed to invest on this land for bargaining purposes. But in practiee this was rarely followed. Even now land is available in Sector I if one is agreeable to pay 3 or 4 times the original value. Apart from this the value of lands developed by Housing Department in and around Calcutta is almost beyond the reach of common people. Minimum price for a 3-room flat is Rs. 70000 under 'Own your own Flat' scheme whether constructed by private or government agencies.

Moreover, the budget for 1977-78 contains a number of measures designed to promote investment. Capital gains arising from sale or transfer of any property held by a tax-payer for more than 36 months are proposed to be exempted from income-tax in cases where full value of consideration from transfer is invested in specified financial assets. If capital gains are so exempted from tax, one can easily imagine the impact of this development on the value of land.

Market price is not a conclusive test of real value. The value to be ascertained is the price to be paid for the land with all its potentialities. Value, however, does not always depend on supply and demand because supply and demand depends on value. Generally the value of land is determined by the rent which it yeilds. it therefore follows that the greater the rent, the greater is the value to the owner of the property. Value of the land is the capitalised value of its rental. So the present value of the land cannot be justified by the standard valuation procedure.

In the present system there is no law to curb the exhorbitant value of the lan But we know that after the passing of the Calcutta Rent Restriction Act 1920, valu fell rapidly in the city and between 1920 and 1930 there was a fall varying betwe 25 and 30%. In the Cities and Metropolitan Districts rent of houses and flats a exhorbitant and still are on its upward trends. So the value of the land can only b controlled indirectly if government pass the Rent Restriction Act. But all the measures are by no means a permanent solution.

Constitutions of the majority countries all over the world provide Rights of wor Education and Food as 'fundamental rights'. Under the draft revised constitution o the U.S.S.R., now under adoption, 'Right to a Home' is being included as a 'fundamenta right'. In Great Britain over 9 millions new Dwellings have been built by the Loca authorities, helped with generous Funds from the Central Exchequer, since 1945, so tha 60% families are provided with Housing accomodation. Here the area of each dwellin is related to family sizes and not on income consideration.

So the evident fact remains that the governments of these countries, be it socialist, communist or democratic, are more and more realising the need for Housing and are on a firm step to face this fundamental problem without any delay. Now it is high time for us to think over this matter seriously and revise our constitution too, so that 'Right of House' become a 'fundamental right'.

Planned development has a far reaching effect. It will not only help to clear slums from the cities it will help the old houses in modernising by improving light, ventliation and sanitary condition for healthy and decent living. Scientific planning techniques for regional development i.e., dispersal from congested areas will promote creation of new towns. Some offices and firm can move to these new towns whereby opportunities for new jobs in expanding towns and consequently remove pressure of overcrowding on the existing town will be possible. So by introducing this fundamental right government will not only mitigate the sufferings of common people but will help the nation in building a healthy atmosphere for the future generation.

CARDIAC PACEMAKERS

By

T. G. KRISHNA MURTHY

The use of electronic pacemakers to augment the heart beat rate in certain types of diseases associated with the heart is now clinically well established. It has taken nearly two decades of relentless research efforts which still continue to improve the longivity and reliability of this prosthetic device. Over two lakh units have been implanted all over the world. Many who were badly afflicted have gone back to lead active and useful life, ever since the first unit was implanted in 1958. Implantation of pacemakers began almost a decade back in India (1967). To start with implantation was being done at 3 or 4 centres. Gradually, the number increased. At present it is being done in 10 to 12 centres. To date, over 800 units have been implanted. The longivity has ranged from 24 to 30 months in case of fixed rate units and about 18 to 20 months in case of triggered ones. Mainly, MEDTRONIC and DEVICES pacemakers have been utilised by specialists. CORDIS, BIOTRONIX and LUCAS units have also been implanted. Usage of integrated circuits besides reducing the size azd weight has led to greater reliability. Better encapsulation has prevented seapage and led to longer life of the devices. In the last couple of years, units powered by nuclear cells have been implanted. A life expectancy of atleast 10 years is anticipated.

T. G. Krishna Murty, Bio-Engineer, 24. Santhi Kutir, 15th Cross Road, Malleswaram, Bangalore-560003.

This paper was received on December 27, 1977.

The cost aspects are important in a country like India. In fact the high cost from living standards here has prevented many poor persons from having the device implanted. The cost of the unit alone comes to about rupees five to six thousand. One has to add the other expenses the patient has to incur for himself and atleast one attendant towards travel stay and hospitalization. Specialists rightly fear that the number of implantations would have been three or four times more than the number implanted. So far, had the unit cost been in the region of rupees two thousand five hundred. The MEDTRONIC are to be lauded for their gesture in bringing out an economy unit for exclusive use in underdeveloped and developing nations at a cost of about rupees three thousand and seven hundred fifty. Clinical experience of more than a decade has established the invaluable usefulness of this prosthetic device.

As already indicated, implantation of pacemakers began in India in 1967. Implantations have been done in Bombay, Delhi, Vellore, Chandigarh, Calcutta, Lucknow, Bangalore, Poona, Mangalore. Most likely some more Centres may start as the surgical technique is not complicated. Clinical experience of a decade shows that the units have been reliable. In general, the units have not lasted the period claimed. Reimplantations have been done when the pacing rate slowed down due to cell

depletion, The present trend is to use triggered units. In selected cases, the fixed one can be used in view of its simplicity lower drain and longer life Education of public and the general physicians is an extremely important factor. There has been reluctance on the part of practitioners to handle and advice patients. Long terms follow-up indicated infection in some cases. In such cases, reimplantation has been done using new units. Long term follow-up results have been most encouraging. Few deaths have been reported during follw-up. Some of these were due to other pathological factors associated with the patient..

Many initial drawbacks have been overcome and there is continuous efforts to improve. Prosthetic devices pose a special problem as they are to be life long and permanent implants inside the body. Various interface problems arise in case of such long term devices. The main field of application of alloplastic materials so far has been the musculo skeltal system. Only in recent years, prosthesis has made in roads into the cardiovascular system. Besides nearly two lakh pacemakers implanted to date. Over 150,000 live with vascular prosthesis. In about 70,000 artificial heart valves have been implanted. Bio-materials sciences is the new interdiscipline which attempts at better understanding of the implant materials in vivo. Lack of knowledge about the full implicalions constrains application of surgical prosthesis. However in acute and emergency cases, there is no alternative except to give relief to the patient by corrective surgery. In practice, it is too early for evaluation of materials from a long term viewpoint. Implant materials are basically of three types namely (a) Blood compatible materials—materials used in vascular prosthesis, oxygenators, heart valves, artificial kidneys, cardiac assist systems, catheters and other permanently implanted materials in contract with blood. (b) Materials for tissue implants—pacemakers encapsulation, leads, biofeul cells, tissue adhesives etc., and (c) Materials used in arthopaedics and in dentistry. The study of the physical, mechanical chemical, electro-chemical, biological and physiological aspects of biomaterials involves an integrated approach by doctors, scientists and engineers. Biomaterials sciences is beginning to receive attention in India also. Long term financial support is essential for research and development efforts in this field. The amount of scientific and technological success in this field can never be measured by the extent of commercial exploitation and success.

Concluding, the future use of this prosthetic device mainly depends on the availability of moderately priced units. Well trained physicians and surgeons who are conversant with the technique and who can appreciate the therapeutic value of the device are eqully essential. Public education is yet another extremely important factor which can lead to increased utilisation of this invaluable device which gives new lease of life to the handicapped.

BIBLIOGRAPHY

1. M. L. Bhatia—Long term transvenars fixed rate endocardial pacemaking in treatment of heart block.
Indian Heart Journal Vol 21 No. 3 July 1969.

2. M. L. Bhatia—Experiences with permanent implanted pacemakers. Surgical Journal of Delhi. 10, 2, 28-34.
3. Krishnamurthy T. G.—Implantable Cardiac Pacemakers. Probe 12.1,11-14
4. Krishnamurthy T. ·G.—Implantable Pacemakers Probe 14, 3, 229-231.
5. Krishnamurthy T. G.—Implantation of pacemakers in India. The Clinician 38, 2, 97-100.
6. Krishnamurthy T. G.—Implantation of Pacemakers in India. 5th International Symposium on Cardiacpacing. Tokyo, March 1976.
7. Schaldach. M.—Implantable Materials. Med. Pro. Thro. Tech. New York. 3, 2, 73-83.
8. Krishnamurthy—T. G.—Plasticsin Implantation. The Clinician, 40. 4, 187-189.

Design and Manufacture Mini Plough

By

HEM CHANDRA CHATTERJEE, Ph, D , D. B. A., P. E,, P. Mgr., C. Eng. (Ind.), M. I. E., M, I. B, T. E., S. M, I. E. E., M. I. S. E. etc,

We must all concern ourselves with the growing need fo fgood due to population-growth in India. For good climatic conditions we might grow more crops and satisfy the present need. But that is not true all the time. We also need some types of modern equipment to distribute to the poor farmers to increase the food production. Of course the equipment should not be expensive like a tracior. It should be economical, a handy tool of farmers.

Many attempts were made to increase the production of food for the millions. Most of them were in large scale, good for vast land owners or for the pool of many medium size farms. This is a paradox. Contrary to our present policy of distributing lands to the individually owned small farms and to poor farmers, it is impossible to give all of them expensive tractors to till their lands. Farmlands in West Bengal, Bihar, Orissa, Assam and many other states are not suitable for tractor-tilling ; ox or buffalo-drawn ploughs are not efficient and can not reach proper tilling depth. Therefore, mechanical ploughs will help to solve this problem. Very few concepts have materialized as yet to provide small farmers the right type of tool to increase food production. The mechanical mini plough will be the best tool to help the farmers. Its moderate price and easy handling would make it attractive in the market.

Two differnt types of ploughs may be

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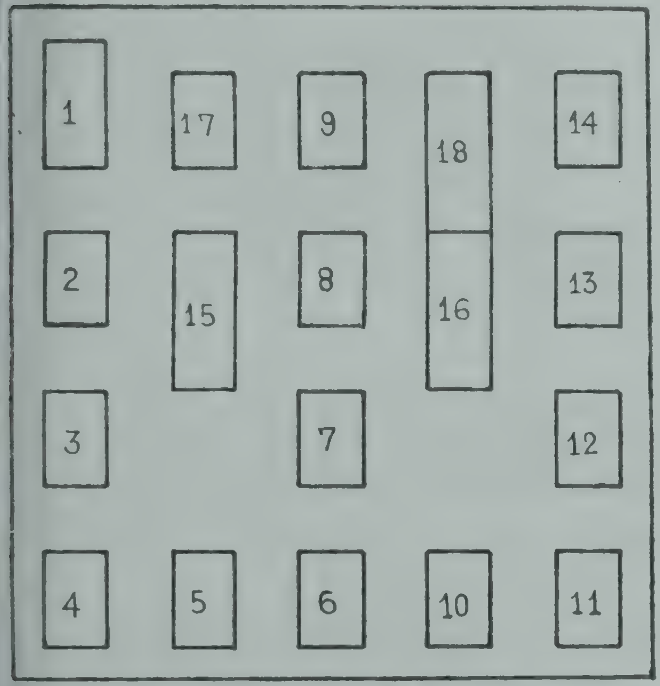
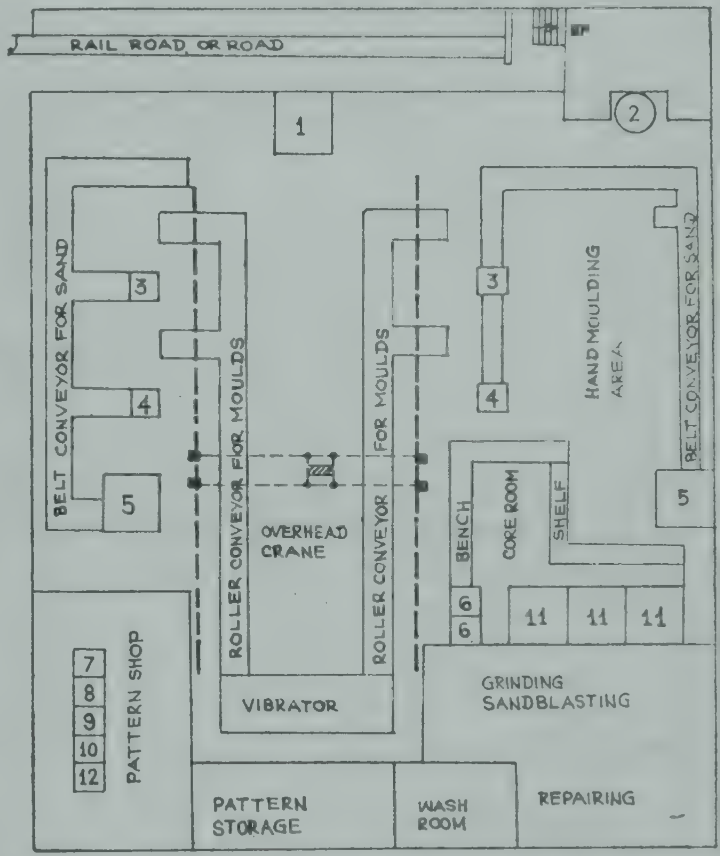
made : 1. A plough suitable for dry land. 2. A plough suitable.for wet or muddy land. These two ploughs may be made in many different sizes according to demand. The mechanical mini plough should be mounted on rectrangular frame on two wheels driven by internal combustion engine. Rotation of ploughshaft by sprocket reducer should be linked directly from the driven shaft with roller chain. Twelve plough blades should be attached on the ploughshaft in four rows at one hundred and twenty degree apart.



1 LAYOUT TABLE
2 VERTICAL DRILL
3 PEDESTAL DRILL
4 BORING MILL
5 SHAPER
6 HACK SAW
7 ENGINE LATHE
8 TURRET LATHE
9 SCREW MACHINE
10 MILLING MACHINE
11 BROACHING
12 BORE GRINDER (HONING)
13 SURFACE GRINDER
14 SHAFT GRINDER
15 QUALITY CONTROL OFFICE
16 FOREMAN'S OFFICE
17 WASH ROOM
18 LOCKER ROOM

Figure 1. Machine shop arrangement

The steering system shall be operated by muscular force applied on handle rod with two grips, with forward motion being achieved by V-belt pulley reducing system. V-belt pulley shall be driven by main engine shaft but can be idled by means of spring loaded clutch mechanism. Small lever with about twenty pounds movement shall be sufficient to couple the forward motion. All drive mechanism, engine and the fuel tank shall be covered in sheet metal box-type enclosure. leaving only ploughs and wheel exposed. Figure 1 is a typical mechine shop arrangement to manufacture mechanical mini ploughs.



1 COUPOLA
2 ELECTRIC FURNACE
3 MOULDING MACHINE (COPE)
4 MOULDING MACHINE (DRAG)
5 SAND PREPARING MILL
6 CORE PRESS
7 JIG SAW (BAND SAW)
8 SANDER (BAND)
9 SANDER (DISC)
10 DISC SAW
11 CORE DRY OVEN
12 DRILL

Figure 2. Foundry layout

The mechanical mini plough suitable to till soft swamp-land or for making mud for paddy fields shall be a narrow structure type

At the centre there shall be a hitch to attach the connecting rod. The end of this rod shall provide the attachment of inter-changeable plough blades. Practically all blades shall be shovel type with pointed-end narrow-shaped deep-drawn three-cavity structure to provide a piercing and spreading action. Other tools would be a fork rotating disc and a leveler. The two wheels would be independently suspended from the structure with help a zig-zag shaft which would provide a steering mechanism. Figure 2 is a typical foundry layout to manufacture mechanical mini plough.

Crude oil may be used to run the engine. Solar battery-bank may also be used to run an electrical motor as a prime mover. Development of solar energy will make plough more economical.

ACKNOWLEDGEMENT

(Author acknowledges help of Mr. P. K. Goswami MISE, VDI to write this article).

The Multiplying Magic Square

By

Dr. M. N. DUTT

Prof. of Physics, J. C. GHOSH, Polytechnic

ABSTRACT

A general theory of multiplying magic square of third forth and fifth order has been discussed in this article some new relations between existing facts have been established. Many important properties of this magic square are explained by the algebraic representations.

Introduction

A multiplying magic square is one in which integers (in the cell) when multiplied one another in column or row or diagonal line will yield the same result. The integers must be non-consecutive. It is found that if order is n, then the result is x^n where x is the (whole number) integer.

Third order multiplying magic square (n=3)

$x=6$

The figure No. 1 is an example when these integers are multiplied, the result is 216.

12	1	18
9	6	4
2	36	3

Figure No. 1

2x	$\frac{x}{6}$	3x
$\frac{3}{2}x$	x	$\frac{2}{3}x$
$\frac{x}{3}$	6x	$\frac{x}{2}$

Figure No. 2

let x=6, then the algebraic representation of Figure No. 1 will be Figure No. 2. The product of any column or row or diagonal line=x^3. By using mirror and rotation 90°, 180° and 270°, it is possible to obtain more magic squares.

Side reflection

3x	$\frac{x}{6}$	2x
$\frac{2}{3}x$	x	$\frac{3}{2}x$
$\frac{x}{2}$	6x	$\frac{x}{3}$

Figure No. 3

90° Rotation

3x	$\frac{2}{3}x$	$\frac{x}{2}$
$\frac{x}{6}$	x	6x
2x	$\frac{3}{2}x$	$\frac{x}{3}$

Figure No. 4

270° rotation

$\frac{x}{2}$	6x	$\frac{x}{3}$
$\frac{2}{3}x$	x	$\frac{3}{2}x$
3x	$\frac{x}{6}$	2x

Figure No. 5

180° rotation

$\frac{x}{3}$	$\frac{3}{2}x$	2x
6x	x	$\frac{x}{6}$
$\frac{x}{2}$	$\frac{2}{3}x$	3x

Figure No. 6

The following conclusions are arrived :-

(1) The lowest whole number is 6. (x=6)

(2) x lies at the intersection of the diagonals

(3) The numbers in the cells are skewly related so that the product of any two=x^2

(As $2x \times \frac{x}{2}=x^2$, $3x \times \frac{x}{3}=x^2$

$\frac{x}{6} \times 6x=x$, and $\frac{3}{2}x \times \frac{2}{3}x=x^2$)

4) If the numbers in the cells are raised to any power and are plaeed in the respective cells, thee the new magic square will retain all the previous properties.

Multiplying magic square of 4th order

$3x$	$\frac{4}{5}x$	$\frac{5}{3}z$	$\frac{x}{4}$
$\frac{x}{10}$	x	$4x$	$\frac{5}{2}x$
$\frac{20}{3}x$	$2x$	$\frac{x}{8}$	$\frac{3}{5}x$
$\frac{x}{2}$	$\frac{5}{8}x$	$\frac{6}{5}x$	$\frac{8}{3}x$

Figure No. 7

The above figure is an algebraic representation of multiplying magic square of 4th order.

The following are the important properties (noted from the above figure).

(1) The lowest whole number is 120 ($x=120$)

(2) The product of four integers around the Centre is x^4 $\left(x,\ 4x,\ 2x \text{ and } \frac{x}{8} \right)$

(3) The product of four integers at the four corners of the square is also equal to x^4 $\left(3x.\ \frac{x}{4},\ \frac{x}{2} \text{ and } \frac{8}{3}x \right)$

Plane mirror reflection

Side reflection

$\frac{x}{4}$	$\frac{4}{5}x$	$\frac{5}{3}x$	$3x$
$\frac{5}{2}x$	x	$4x$	$\frac{x}{10}$
$\frac{3}{5}x$	$2x$	$\frac{x}{8}$	$\frac{20}{3}x$
$\frac{8}{3}x$	$\frac{5}{8}x$	$\frac{6}{5}x$	$\frac{x}{2}$

Figure No. 8

180° rotation

$\frac{x}{2}$	$\frac{5}{x}x$	$\frac{6}{x}x$	$\frac{8}{3}x$
$\frac{x}{10}$	x	$4x$	$\frac{5}{2}x$
$\frac{20}{3}x$	$2x$	$\frac{x}{8}$	$\frac{3}{5}x$
$3x$	$\frac{4}{x}x$	$\frac{5}{x}x$	$\frac{x}{4}$

Figure No. 9

90° rotation

$\frac{x}{4}$	$\frac{5}{2}x$	$\frac{3}{5}x$	$\frac{8}{3}x$
$\frac{5}{3}x$	$4x$	$\frac{x}{8}$	$\frac{6}{5}x$
$\frac{4}{5}x$	x	$2x$	$\frac{5}{8}x$
$3x$	$\frac{x}{10}$	$\frac{20}{3}x$	$\frac{x}{2}$

Figure No. 10

270° rotation

$\frac{8}{3}x$	$\frac{6}{5}x$	$\frac{5}{8}x$	$\frac{x}{2}$
$\frac{3}{5}x$	$\frac{x}{8}$	$2x$	$\frac{20}{3}x$
$\frac{5}{2}x$	$4x$	x	$\frac{x}{10}$
$\frac{x}{4}$	$\frac{5}{3}x$	$\frac{4}{5}x$	$3x$

Figure No. 11

The common property of above two multiplying square magic squares are that any power of the numbers placed in vacant squares are also magic. As for examples square of table No. 2 is,

$(2x)^2$	$\left(\frac{x}{6}\right)^2$	$(3x)^2$
$\left(\frac{3}{2}x\right)^2$	x^2	$\left(\frac{2}{3}x\right)^2$
$\left(\frac{x}{3}\right)^2$	$(6x)^2$	$\left(\frac{x}{2}\right)^2$

Fig. No. 12

it satisfies the condition of multiplying magic square.

Fifth order multiplying magic square

The figure No 13 is an algebraic representation of fifth order multiplying magic square.

$\frac{x}{5}$	$\frac{x}{3}$	$6x$	$\frac{x}{4}$	$10x$
$\frac{1}{32}x$	$2x$	$8x$	$\frac{x}{7}$	$14x$
$50x$	$\frac{3}{56}x$	x	$\frac{56}{3}x$	$\frac{1}{50}x$
$32x$	$7x$	$\frac{1}{8}x$	$\frac{x}{2}$	$\frac{1}{14}x$
$\frac{1}{10}x$	$4x$	$\frac{1}{6}x$	$3x$	$5x$

Figure No. 13

The following important points are noted

(1) The least whole number is 16800 $(x)=16800)$

(2) It is a symmetrical multiplying magic square. The numbers are skewly related, so that the product of two numbers is x^2.

(3) The integer at the intersection of two diagonals is x.

Reference :

(1) Bakst, Aaron. Mathematical Puzzles

(2) Bergholt (1910). Nature Vol LXXXIII P 368

(3) Bowers, Henny, Mathematical recreations

(4) Cameron, A, Mathematical enterpreses

(5) Dutt, M. N. (1971), J. Sci. Club, 25, 28

(6) Dutt, M. N. (1973), J. Sci. Club, 27, 101

(7) Dutt, M. N. (1974), J. Sci. Club, 28, 118-119.

(8) Gardner, Martin, Mathematical Puzzles

(9) Health. R. V. Mathematical magic, Puzzles

(10) Hunter, J. A. H. Mathematical diversions

(11) Kraitchik, Mathematical recreations

(12) Loubere, S. De La (1693) Du Royaume de Saim

13) Plank, C. The Monest (Chicago) (1919) Vol XXIX

(14) Riechmann, W,F. The fascination of nnmbers P 152

(15) Rosser, J. B. and Walker R. J. (1938) Bulletin of American Mathematical Society Vol XLIV. P 416

(16) Rouse Ball, W.W. Mathematical recreation and essays.

(17) Schots, M. H. Bnlletin de La classes des sciences (1931) P 339.

(18) Smith, D. C, History of Mathematics (1925) Vol II P 591

(19) Strachery Ralph (1956) Mathematical recreation By Ball P. 196.

Development of Handloom Industries in India

By

RAKESH COOMAR, B. A., D. H. T., L T I

(*Continuation from previous month*)

A special variety of handloom products is calssifield state-wise which is having export potential.

State-wise classification is as given below :

Andhra Pradesh

Tie & dye cotton material, Kalam Kari points, superfine muslin, furnishing, bed-cover, durees, pile carpets, dress-material.

Assam

Mattco and Muga Silk, suiting, shirting and dress material.

Bihar

Khari and Besist on handloom clothes, satins, patolas, bandhani and dress material.

Haryana

Jacqard designs, bed-covers, furnishings and decorative durries.

Jammu and Kashmir

Tabisilk, crewal embroidery, funishing, woolen mamda, embroidered woolen crobs, silk scarves, stoles and printed sarees.

Karala

All kinds of fnrnishing, lungi, towels, Jacquard, furnishing, shirting and bed-covers.

Tamil Nadu

Lungi, Madrasi handkerchief, shirting, towels and turksih towels and bed sheets.

Madhya Pradesh

Bed sheets, cotton prints, furnishing. darees, superfine sareds, art-silk, muslin with border, chanderi saree and dress material.

Maharashtra

Himroo, jacquard bed sheets, wall hangings, superfine sarees, darees, artsilk varieties and dress material.

Manipur

Woolen and embroidered bed covers and handbags, decorative fabrics.

Karnatak

Mulberry silk, fabrics of all kinds, artsilk and Mysore saree.

Orissa

Tie and dye silk and cotton materials, tussar silk, Ikkat with extra warp figures, bed covers, furnishing and dress material.

Punjab

Woolen blankets, bed sheets, towels and dress materials-

Rajasthan

Prints in indigenous clours, tie and dye clothes know as bandhanies, chandari saree, lahoria saree.

Uttar Pradesh

Silk saree with border, brockets, cut-work

dress material, silk clothes, and scarves, woollen and cotton carpets printed dress material. bed covers, necktied and printed bed covers.

Delhi

Bed covers, neckties, printed dress material, long clothes, woolen carpets.

West Bengal

Tussar silk, printed silk sarees, silk dress material and super fine cotton sarees.

1. Director of Commercial Publicity, Ministry of Foreign Trade, Government of India.

This directrate performing the following function for the Development of Textile Industries.

(a) Conducts commercial publicity through various media, monthly, publications viz the journals of industry and trade, Foreign Trade, Govt. of India, Udyog Vyapar Patrika the journals includes special articles on Foreign trade of India and give hints to business men to export.

(b) Publicity through documentary, films, Radio, and photographs etc.

2. Director of Transport.

This director deals with priority and freight concession on the movement by rail of the goods for export and local, shipping, Air facilities etc. for Handloom Trade.

3. Director of Export Asstt.

This Director deals with problems and facilities standing in the way of export and also help for rebate, Licences and raw materials for Handloom Trade.

4. Director of Exhibitions.

This Director helps in the developme Handloom by providing the following of assistance :

1. Arranging participation in internati Exhibition.
2. Arranging Indian Exhibits in aboard.
3. Running show rooms in Foreign Co tries.
4. Setting up trade centres in selected portant Market outside India.

Export Promotion Councils

These following export promotioncoun are registered under the Company Act a non profit seeking organizations. The exp promotion council examine various asp of export promotion such as price, quali packing, marketing, transportion etc.

At present these are the following expo promotion councils who deals with th development of the Textile Trade.

1. Silk and Rayon textile promotion cou cil.
2. Cotton Textile Export promotion Cou cil.
3. Wool, and woolen goods Export Pro motion Council.
4. Handloom Export Peomotion Council.

The following assistance are provided b the Export Promotion Council for th development of the Textile Industries.

1. Arranging market survey.
2. Publication of the Reports, and infor mation concerning foreign trade.
3. Developing trade centres.

4. Settlement of the trade disputes.
5. Assisting quality control.
6. Joint participation in trade fair and exhibitions in abroad.
7. Publications, domestic, overseas market, publication of the Export Directory.
8. Administration of the Export Promotion Scheme.
9. Sponsoring Foreign Tours.

Commodity Board

Various Commodity Boards have been set up under the administrative control of ministry of Foreign Trade. These boards has been with a view to help the Handloom manufacturers, exporters in the trade of traditional items and also undertakes promotional activities provides incentives assistance to the exporters participation in the exhibition, fair and aboard for the development of Textile Trade.

At present there are five commodity Boards who are helping the Textile Industries for its developments.

1. All India Handloom Board.
2. All India Handicraft Board.
3. Khanndi and Village Industry Boad.
4. Central Silk Board.
5. Coir Board.

Trade Representatives of India aboard

India has trade representatives in Foreign Countries. These trade representative gives the reports to the Govt. regarding the products. The following assistance is provided by the trade representatives to the export of Textile Trade.

1. Conducting the marketing survey and research.
2. Supply of names and addresses of importers of specific commodity.
3. Reports and information about particul export controls.
4. Developing trade contracts and helpir Indian Busiuess men .visiting abroad respective countries for certain comm dities.

5. Getting information on rules and regul lation for imports laid by a foreign country.
6. Setting trade disputes.

Indian Council of Trade and Exihibitron

It is registered society sponsored Govt. of India, which works in clos colaboration with the Ministry of Foreig Trade. The purpose of the council is promote and organise participation in t trade fairs and exhibitions both in Ind and aboard. Establishment of trade centr and the development of the other progr mmes of commercial publicity for expo promotion. This council is not pro making organization.

ederation of Indian Export Organisation (F IEO)

This is an apex organization set in 1965 as a society promote exporting interest in India. The Federation performs activities for common nature such as sending trade delegation abroad and inviting trade delegations from Foreign countries, sponspring commedity and market surveyes collection and dissemination of commercial intelligence. F I.E.O. provides facilities for settlement of trade disputes arising in the course of foreign trade and advises Govt. on all matters relating to export trade.

Handicrafts & Handloom Export Corporation of India

The Corporation undertakes direct export on behalf of manufacturers. The assistance of the corporation is available to exporters of handicrafts and Handloom items who enrol themselves as the Associates In case of Handloom items a scheme has been evolved so that the corporation grants preshipment advance up to 90% F.O.B. value. Against confirm export order at normal interest or on the security or hypothecation of stock in trade.

The corporation arranges the bulk import of rawmaterials and also rendering services of supply Designs suitable for export market and distribution of imported raw materials like Yarn, Dyes and Chemicals.

Trade Development Authority (TDA)

This organization has been set up by the Govt. of India to offer assistance to exporters in a cordination and intograted manner, the T.D.A. is registered society under the registration Act. Primarily the organisation is providing assistance to medium and small scale units.

The authority collects and furnishes informations regarding exporters and export market, does market research, assists in export finance and renders help in securing and implementing export order.

Book Review

Building practice. 1977 Annual. Edited by Madhukar N. Gogate. Forth Floor, Tardeo Airconditioned Market. Bombay-400 025. Rs. 20/- per copy in India and $ 5 (Foreign). 54 pages. Periodicity Annual.

This journal is meant mainly for the practising engineers and architects. Timely editorial is undoubtly represent the true voice of engineers and architects. Articlts in this volume deal with the engineering problems relevent to the construction and design of building industry. Articles like Corrosion Problems in RCC Buildings, Roofing for Industrial Needs, Quick RCC Design and Building Cost Analysis are really helpful for the budding engineers and architects. Here and There consisting of relevant information on building industry is commendable attempt on the part of the editor to make this journal perfect in all respect. This journal is too costly otherwise this journal is expeeted to be an useful media for exchanging view add developing ideas among the engineers and architects engaged in the profession.

NOTES & NEWS

Genetic Engineering

The development of genetic engineering is under way in USSR and in near future it is expected that its application in medicine will be for hereditary diseases the genes obtained in the laboratory will be used for treating diseases a procedure that may be called genotherapy.

Practical application of genetic engineering in agriculture will help in accelerated production of useful hybrids, using cell culture for genetic and other purposes, even in such an operation as the transfer of the nitrogen-fixing gene.

Training Course on Control of Contaminants on Foods

A six-months international Training course on control of environmental cotaminants in food has commenced at the Central Food Technological Research Institute (CFTRI). Mysore, on 21 November 1977. The course has been sponsored for the first time in India by the Foods & Agriculture Organisation and United Nations Environmental Program and is being attended by 14 participants from Bangladesh, Cuba, Egypt, Fiji, Ghana, India, Jamaica. Mexico, Nepal, Philippines, Syria, Thiland and Zambia. The main thrust of the course will be on three major groups of chemical contaminants, viz. heavy metals especially lead, cadmium and mercury, pesticide residues, especially

of organochlorine type, and mycotoxins, especially aflatoxins.

DC Motor Controler

A DC motor controller using thyristors has been developed at the National Aeronautical Laboratory, Bangalore, for motors of upto 10 HP capacity. The unit is reversible in its applications and can be used for all types of Dc motors-series, shunt, compound etc. The modular design helps in having easy manufacturing procedures and upscalling of the controller for high power motors.

New Accelerator to study Nuclear Structure

A Van de Graff accelerator now being built at the UK Science Research Council's Daresbury Laboratory, and scheduled to be completed in 1980, will be the largest in the world.

Soft Contact Lens for Bifocal Vision

Polyvinyl lens from Focus Contact Lens Laboratory, of Watford, near London, combines gradual change of focus from long to near vision with the comfort typical of soft lenses. To see things at a distance, the wearer look through the inner circle. For close work, the eyelid holds the lens up while the eye looks down through the outer rim.

Exploration and Management of Ground Water Resources

Intensive geophysical surveys for ground water were carried out both drinking and irrigation purposes, in drought prone areas and backward regions of Andhra Pradesh The districts covered so far in this program are Karimnagar, Mahubnagar, Warngal Kurnool, Anantpur, Guddapah and Prakasm Drilling based on geophysical investigations has mostly been successful.

Some areas have been selected for detailed ground water management studies in collaboration with Central Ground Water Board in the States of Andhra Pradesh, Orrssa, Maharastra, Tamil Nadu and Uttar Pradesh.

Future Programes

The NGRI is initiating observation and reseaach on NE Indian region in the Himalakan vicinity to carry out earthquake predictiction studies.

Consub Submersibles

British Aerospace, Dynamic Group at Bristol has developed CONSUB 2, the unmanned Submersible work vehicle, will be used extensivtly in maintenance and inspection work for offshare industry.

The results achieved to date with CGNSUB 2 under operational conditions have excited the oil industry. The excellence of the underwater video, the recovery of debris, precise survey measurements, detailed inspection with colour video, and production of on line survey information on board the support vessels have proved conclusively the viability and potential of the unmanned submersible.

SOCIETY NOTES

NEW MEMBERS

(*Elected on 9-9-77*)

Graduates :

Puran Prasad Singh, Grad—812
Vill-Baratar,
P. O. Sabejore, (via) Madhupur,
Dist. Dumka, (Bihar)

(*Elected on 31-10-77*)

Membership :

Govinda Modak. M—752
4/1, Mahendra Road,
Calcutta-700025

A Easwariah, B. E. M—753
No. 12, New Tank Street,
Nungumbakkam,
Madras—600035.

Jai Krishan, B.A. M—754
Inspectorate of Armaments,
Ambajhari,
Nagpur—440021.

A. Ravisanker, B. E. (civil) M—755
42, Sivapuram,
Tirunelveli Junc. 627001.

Associate Membership :

E. Ravindran, AM—2983
No. 8 G. T. S., Air Force,
C/o. 99 A.P.O.

S. Anjaneyulu, AM—2984
Airmen's Mess, A. F. Stn.,
Makarpura, Baroda-391720

A. V. Thomas, B. A. AM—2985
'Asanparampil House',
P. O. Karthigappally,
Distt. Alleppey, Kerala.

Bankim Ghosh, AM—2986
80, N. K. Ghosh Road,
Calcutta-700042

Chandra Pal Singh AM—2987
TCCF, Air Force Stn.,
Yelahanka, Bangalore-562115

R.H.M. Lukmanul Hakim AM—2988
9, Ahamudiyar Koil Street,
P. O. Periya, Agraharam,
Erode-638005

Muniswamy Devdas AM—2989
H-12, Navy Nagar,
Colaba, Bombay-400005

V. Ganga Dharan AM—2990
108 Sqdrn., Air Force,
C/o. 56 A.P.O.

P. Ramkrishnaiah AM—2991
203 Unit 4, South Side,
Powel House, Kharagpur W/Shop,
S. E. Rly, 721301

L. R. Sabat AM—2992
Vill & P. O. Sukinda,
Distt. Cuttack, Orissa.

Dilip Kumar Banerjee AM—2993
Fire Protection Director,
W. B. Fire Officer (Spl) Services,
13-D, Free School Street,
Calcutta-700 016

Tarsem Singh Minhas, POEL, AM—2994
I.N.S. Talwar, C/o. F.M.O.,
Bombay-400 001.

U. Krishna Murthy, AM—2995
C/123, Ram Nagar,
(TTD Qtrs.) Tirupati-517502

A. K. H. Munshi AM—2996
,Khan Building',
D Block, Ist floor,
Nawab Tank Bridge, Mazagaon,
Bombay-400 010

A. Morgan Fernandez AM—2997
89, Gopal Reddiar Colony,
Perambur, P.O. Jawahar Nagar,
Madras-600082

Cpl. K. Sundharan AM—2998
Stn. Workshop, No. 16 Wing,
Air Force, C/o. 99 A.P.O.

K. Vijayan, D.E.E. AM—2999
26 Venkatachala Mudaly Street,
Vepery, Madras-600007

Vinayak Das AM—3000
27-A, Panditya Road,
Calcutta-700 029.

Sudarsan Barik, B. A. AM—3001
Public Relation Officer,
The Corporation of Calcutta,
Calcutta-700 015

Inderjit Singh Grewal AM—3002
G. E. (P) No.1,
Faridkot, Punjab.

P. M. Sathawane, LEM (P) AM—3003
Base Maintenance Unit(W&L),
Naval Dockyard,
Bombay-400001

Sgt. P. K. Ramachandran AM—3004
S.N.C.O's Mess. Air Force,
Jallahalli East, Bangalore-560014

M. Abdul Khader, AM—3005
Weaving Master,
M/s. Western India Cotton Ltd.,
P. O. Pappinissery-670561

Cpl. K Sethumadhavan, AM—3006
No. 3 B.R.D., Air Force,
Chandigarh-160003

Sgt. T. E. S. Badsha, B. Com, AM—3007
Power & Air Cond. Section,
R. C. P. O., Ministry of Defence,
DDA Building, A-1. Block,
Safdarjung Enclave,
New Delhi-110016

R. Rama Raju, AM—3008
Sppdt. B/R Gd. I,
C. E.'s Dry Dock Office,
9 IRSD Area,
Visakhapatnam-530008

Cpl. C. V. Kunjappan AM—3009
No. 8 G.T.S., Air Force,
C/o. 99 A.P.O.

Cpl. Bhairab Datt, M. A. AM—3010
Tech. H. Q., Air Force Stn.,
Hakimpet, Secunderabad-500014

W. C. Watharker, LEM(P) . AM—3011
Defence Service, Ald Block,
I. N.S, Garuda, Cochin-682004

Sgt. M. Visweswaraiah AM—3012
Vill & P. O. Karakamukkala,
(via) Vid Apanakal,
Distt. Anandapur, (A.P.).

Cpl. Devasagayam, Rad/Fit. AM—3013
No. 3 Sqdrn., Air Force,
C/o. 56 A.P.O.

I. Jayapalan. AM—3014
3rd Engineer Officer,
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'Shipping House', Calcutta-1

Ramanathan Pandian, DEE, AM—3015
7, Old Girls School Street,
Jalakanta Puran-639501

Jitendra Kumar, D.E.E. AM—3016
M.O.T., Dredge-VI,
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'Shipping House', Calcutta-1

Cpl. K. Vasavan, B. A. AM—3017
P. Q. 37/3, A. F Qtrs.,
P. O. Kalaikunda Air Field,
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Cpl. K. P. Sulaiman AM—3018
Govindabhai Building,
Kodiyar Colony,
Jamnagar-361003

Sgt. P. D. Gupta AM—3019
No. 2209 Sqdrn., Air Force,
C/o. 56 A.P.O.

Cpl. V. Balasubramanian AM—3020
67/4, New Project, A.F. Stn.,
Poona-410432

Antony Mendex, D.C.E. AM—3021
Supdt. B/R. Gr.I.,
Director General-Border Roads,
'Kashmir House',
New Delhi-110011

Aloke Ratan Ghosh, LME AM—3022
C/o. A. N. Ghosh, AMISE,
62-K, Maharaja Thakur Road,
P.O. Dhakuria, Calcutta-700031.

K. Umasankar, D.M.E. AM—3023
Charge Hand,
Inspection Deptt.,
Building No. 6, M/s. B.H.E.L.,
Tiruchy-620014

Cpl. K. V. Suseelan. AM—302
No. 1(O) N.C.C. Air Sqdrn.,
Bhubaneswar-2

Cpl. M. K. Arjunan AM—302
No. 4 Sqdrn., Air Focce,
C/o. 56 A.P.O.

Sgt. K. Radhakrishanan, AM—302
118, H.U., AirForce,
C/o. 99 A.P.O.

Licentiates :

B. Subramania Pillai, L—56
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AC. J. Vijay Shanker, L—56
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M. Venlkata Rao, L—56
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Kharagpur-721301

Maheshwar Prasad Roy, L—56
C/o. Harkhan Prosad Roy,
Vill-Dumaria, P. O. Dumka,
S.P., Bihar

(*Elected on 30-11-77*)

Membership :

Puran Chand Anand, D.M.E. M—756
CE-25
P.O. Dalmia Nagar-821305

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House No. 1-8-341,
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Associate Membership :

Surinder Singh, B. A. AM—3027
3039, Kacha Bazar,
Ambala Cantt.-133001

V. Madhava, AM—3028
'West House',
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Distt. Palghat, Kerala.

N. Shanmugam, B. E. AM—3029
5/4th Cross Narayana Nagar,
Salem-636001

Om Prakash Yadav, AM—3030
S.M.Q. 151, A.F. Station,
Hindan, Ghaziabad. (U.P.)

J. Sundaresan, AM—3031
No. 222 Sqdrn., Air Force,
C/o. 56 A. P. O.

D. N. Goswami, AM—3032
No. 18 Sqdrn., Air Force,
C/o. 56 A.P.O.

Lakhan Singh, AM—3033
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P.O. Mahesh, Distt. Hooghly (w.B.)

V. C. George, B. A. AM—3035
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C/o. 99 A.P.O.

P. L. Dominic, AM—3036
House No. 80, Shivaji Nagar,
Model Town, Pathan Kot-145001

J. Abraham B.Sc. (Eng). AM—303
'Ottathengil House',
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via) Mannar, Dist-Alleppey,
Kerala

K. Parambadan, B. Sc. (Eng) AM—303
'Kuruppath',
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Kerala

Amiya Ballav Ghosh, AM—3039
C/o. Sri M. B. Ghosh,
Banick Ghosh Bazar,
Cuttack-753002

S. K. Saha. AM—3040
P. O. Box-27,
Doom Dooma-786151, Assam.

A. Ramulu, L.C.E. AM—3041
Asstt. Civil Engineer,
M/s. National Seeds Corpn. Ltd.,
N.S.C. Farm, P. O. Kurnul-518401

X.A. Vincent D.E.E. AM—3042
5/20, Jaffar Syrang Street,
Madras-600 001

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Asstt. Mines Manager,
Century Cement Mines,
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Pin Code-493116. (A.P.).

K. K Govindarajulu, LEE AM—3044
322/4, 3rd Avenue, S.E. Rly.,
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P. Q. 33/3, Kalaikunda Air Field,
Kharagpur-721303

C. Sankaraiah, AM—3046
Electrical Sec. (DSS),
No. 12 Sqdrn, Air Force,
C/o. 56 A.P.O.

Licentiateship

Ivan Jacom, Lem (P). L—565
Electrical Mess,
I.N.S. Himgiri, C/o. F.M.O.,
Bombay-400 001

S. C. Halder, L—566
Sr. Inspector, Production,
Central Orgn. (Elec.), S. E. Rly.,
Kharagpur-721301

B. Bhagavata Rao, L—567
Near Hena Backery
Panch Beria, Kharagpur

K. N. Sharma, L—568
Stage Inspector,
S. S. Incentive Shop No. 51,
S. E. Rly. Workshop,
Kharagpur-721301

T. P. Srinivasan, L—569
GD-1, Winder,
Heavy Elec. Repair Shop No. 53
S.E. Rly. Kharagpur-721301.

Studentship :

Chander Gupt Puri, Stud-126
plot No. 12, Tandon Nagar,
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Punjab.

(*Elected on 30-12-77*)

Membership :

Ravindra Kumar Dutta M—759
P. O. Box-600,
Ministry of Information & Culture,
Muscat, Sultanate of Oman .

Mrs. P. Lathika, B.Sc.(Eng). M—760
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Calcutta-700 029

P. D. Clarence, M—761
Shop Superintendent.
P. C. O. Elec.
Ist fioor of Shop No. 51,
S. E. Rly. Workshop
Kharagpur-721301

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W. O. P.T. Subramanian, WOM-1 AM—3047
Signals, IACC, Air Force,
C/o. 56 A. P. O.

N. C. Srivastava, AM—3048
No. 8 G.T.S., Air Force,
C/o. 99 A. P. O.

W. O. Ajudhia Singh, AM—3049
No. 8 G.T.S., Air Force,
C/o. 9? A. P. O.

A. Satyanarayanan, B.A. AM—3050
Qtrs. No. 24,
P. O. Hindan Air Field,
Ghaziabad-201004 (U.P.)

P. C. Thomas, D.C.E, AM—3051
P. O. Box-4587,
Dubai, U.A.E.

Bhuie H. Singh, AM—3052
P. O. Box-3036,
International Airport Seeb,
Sultanate Of Oman

Ram Niwas, AM—3053
P. O. Box-3036
Seeb International Airport,
Sultanate Of Oman.

Ram Lubhaya Wassesi AM—3054
Gali Mela Pandah,
Kapra Chari Singh-1
Amritsar-143013

Cpl. Ramakant Shukla, AM—3055
No. 18 Sqdrn., Air Force,
C/o. 56 A.P.O.

P. K. Kunhu Mohammed, DME AM—3056
P.O. Box-4148, Doha-Qater
Arabian Gulf.

HemamSharat Singh, AM—3057
Elec. Section, No. 6 Wing,
Air Force, C/o. 56 A.P.O.

Cpl. Raghunath Rath AM—3058
No. 18 Sqdrn., Air Force,
C/o. 56 A.P.O.

A. Alagarsamy, AM—3059
99. Asramam Street,
Lakshmi Puramr727715

R. Sethulingam, D.M.E. AM—3060
55, S. S. Koil Street,
Pollachi, 642001

Mohinder Kumar Pandit,
SMQ. No. 113/3, Tech. Area,
A. F. Station, Aakimpet,
Secunderbad-500014

Cpl. M. K. Alexander, AM—3062
No. 2209 Sqdrn., Air Force,
C/o. 56. A.P.O.

Cpl. K. C. Varghese, B. A. AM—3063
No. 18 Sqdrn., Air Force
C/o. 56 A.P.O.

M. A. Kurian, B. A., LL. B. AM—3064
115, H. U., Air Force,
C/o. 99 A.P.O.

Cpl. T. A. Varghese, B A., AM—3065
Air Force Sulur,
Kangaya Palayam,
Coimbatore-641401

Cpl. Sabha Chand Rathi, AM—3066
P.O. Makarpura Palace,
Air Force Station,
Baroda-391720

Sgt, A. V. Rao Rane, AM—30
S. N. C. O,s Mess, No. 21 Singh,
Air Force, C/o. 56 A.P.O.

K. B. Shrivastava, AM—30
Training Instroctor (Mech),
T.R.G.G' Institute,
N.M.D.C. Ltd.,
KiriBuru, Distt. Keonjhar

Cpl. V. Bharadwaja Raju, AM—30
M. T. R & S., Air Force Stn.,
Bareilly (U.P).

Sgt. Abdul Majeed, AM—307
'Enam Thoppu',
Tennui Eest,
Thiruchirapally-620017

Cpl. Ramchandran Pillai AM—370
112 H. U., Air Force,
C/o. 99 A.P.O.

Licentiateship

Babatope Fakoya, L—57
101, Poonamoliee High Road,
Kilpauk-600010

Gaibi Nate Tewary, L—571
C/o. Sri Shankar Tewary,
Vill-Koldih,
P.O. Sabaijore, (via) Mhdhupur,
Dumka. (S.P.), Bihar.

Ram Prasad Singh, L—572
Centlral Workshop (Insp. Deptt),
C. C Ltd., Barkakana NTS.,
Distt. Hazaribagh. (Bihar).

Rameshwar Tiwari L—573
C/o. Balgovind Tiwary,
MO. Makatpur (Buxidh Road),
P. O & Distt. Giridih. Bihar.

REMINDER NOTICE

Dear Sir,

You have perhaps forgotten to pay the "SPECIAL ANNUAL FEE" for the year 1978. Though this is a mere sum for you, the collection of the same from members is essential to keep the wheels moving for the Society. May I, therefore, request you to please send Rs .... by M.O./Bank Draft/I.P.O. in favour of the "INDIA SOCIETY OF ENGINEERS" by return of post and assit us to serve you. Outstation Cheques should include Rs. 5.00 as Bank Charges.

Please correct your Mailing address, if required and send us the latest resume of your qualifications and attainments for our records.

Rate for the SPECIAL ANNUAL FEE.

F.I.S.E+M.I.S.E.	=	Rs. = 20.00
A.M.I.S.E.	=	Rs. = 15.00
L.I.S.E., Assoc. I.S.E., Grad I.S.E. and stud I.S.E.	=	Rs. = 10.00

NOTICE

I.S.E. will Publish a Directory of Corporate Membership. Interested Corporate Members are requested to sign and return the slip together with Rs. 6/= towards the cost of the Directory.

To
The General Secretary,
INDIA SOCIETY OF ENGINEERS,
12-B Netaji Subhas Road,
Calcutta - 700 001.

Dear Sir,

I am interested for a Directory of Corporate Membership. Sending herewith M.O/I.P.O/DemandDraft for Rs. 6/= towards the cost of the Directory.

Name in full (Block letter)

Grade & Membership No.

ADDRESS Signature

SOME HIGHLIGHTS ABOUT I S E

152 3/6/78

- Incorporated on August 6, 1934, it is in existence for 43 years.
- Its membership is open to Engineers and Industrialists and Technologists, Technicians and Learners alike.
- It now offers membership to respectively qualified persons in seven categories: Fellowship (F.I.S.E.), Membership (M..I.E.), Associate Membership (A.M.I.S.E.), Licentiateship (L.I.S.E.), Associateship (Assoc. I.S.E.), Graduateship (Grad. I.S.E.), and Studentship (Stud. I.S.E.).
- It has on rolls nearly 4500 members within the country and all over the Globe including Bangla Desh, Barma, Ceylon, Singapore. Malayasia, Middle East and African countries the U.K., U.S.A. and West Germany.
- It publishes a Monthly Journal, "SCIENCE & ENGINEERING", from 1935, commanding a circulation throughout the world.
- It maintains a Library containing above 2,000 volumes of Books and Reports.
- It has published some technical text books bynoted Member-Authors, e.g. "Building Materials", & "Mineralogy, Petrology & Economic Geology" : Tables (an enlarged Third Edition of this latter work i. e. the TABLES has been recently published by the Indian School of Mines & Applied Geology, Dhanbad.)
- It conducted Postal Coaching for sometime, also a Refresher Course for Electrical Supervisor's Certificate examinees.
- Its ambassadorial services embrace Lecture Programmes, Inter-Society collaboration and exchange of ideas, delegation to national and world Engineering Congress.
- It of late has urged and brought to the notice of the Government the need for National Engineering & Technology Policy.
- It acts as a principal sponsor of the Federation of Professional Engineering Institutions of India (F.P.E.I.I.) cum the Joint Indian Engineering Council (J.I.E.C.).
- It of late has set up a BRAIN TRUST along with Technical Information Department to provide aid and guide to Operational Research and Practice in different fields of Engineering and Technology.
- It has on its record the association of eminent personalities like Bharat Ratna V. V. Giri, Late Sir C. V. Raman, Dr. Kailash Nath Katju, Dr. J. C. Ghosh, Nawab Zain Yar Zung Bahadur, Prof. Bhim Chandra Chatterjee, Dr. B. N. Dey, Air Vice-Marshal Harjinder Singh, Dr. J. N. Basu and Engineer - Administrators like Dr. K. L. Rao, Dr. T. Sen, Sri T. R. Gupta, Sri P. C. Bose, Sri P. C. Mitra, Sri S. S. Mukherjee, Dr. K. R. Chakravorty, Sri U. P. Mullick, Sri N. Chowdhuri, Sri H. D. Bhowmick, Sri N. N. Chakrabarti, Dr. H. N. Sethna, Dr. R. Ramanna, Sri S. Samaddar and of leading industrialists like Late Shri R. L. Kirloskar of Yantrapur, Mysore, and Shri G.D. Naidu of Coimbatore.

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SCIENCE & ENGINEERING

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Solar Energy And Its Applications

Solar energy is presently a much discussed subject. Many months ago this journal had pointed out a recommendation on the most intensive use of solar energy as a source of energy consumption. Great hopes have now been raised in the potential of solar energy in mitigating the energy issues.

Most of the applications of Solar energy have been explored so far in one form or other. Potential benefits are now being increasingly recognised in certain areas of application requiring low grade thermal energy utilisation. Such possibilities are already there in the fields of heating and cooling of buildings, domestic hot water systems, for refrigeration and agricultural driers, irrigation pumps, power plants and direct conversion to electricity.

There is therefore a distinct area of realisation of new energy through R & D. But because lead time for energy R & D is very long, hence the result of this effort will take time to be felt in a significant way in immediate future. Now the investments in new energy will be a lasting benefit for prosperity in view of the gradual depletion of other forms of conventional resources of energy. Demand for energy is growing at a rate that corresponds to a doubling period of 5 to 7 years for under developed countries and 7 to 10 years in developing countries and 10 to 15 years in developed countries. To reach the expected increase in per capita energy consumption most countries are therefore now trying to explore energy source options.

These new energy sources therefore now include Solar, wind, geothermal tidal and biomass etc. However solar energy is both abundant and harmless under proper technology. Sun is the inexhaus tible source of practically all primary fuels except nuclear energy. Hence the importance of solar energy.

The solar energy density however even at midday is very low compared to what is obtained in industrial equipments. Its peak flux is about 0.1 W/cm^2, quite small compared to heat fluxes of 10 to 100W per sq. cm, common place in boiler or heat exchangers. Technological problem in using solar energy on a mass scale lies here and has to be overcome.

xploitation of solar energy has to be in four categories. Thermal, Heater system in liquid and ga hotovoltaic devices through photosynthetic effects and in photochemical devices, and ey differ quite widely in fundamentals. But the first major problem is the collection of solar energy cheaply and efficiently. It is well known that of the total radiant energy incident upon a surface, a portion is reflected, a part is absorbed, and a part may be transmitted through the object. The energy that is absorbed is only converted into heat

It is also known that the temperature attained by the surface is determined by the balance between the energy absorbed and the heat less to the environment by conduction, convection and radiation. The heat loss increases with temparature, and limits the ultimate temperapture attained by a collector system. The efficiency of collection and conversion is thus dependent on the collector design, storage configuration and load. The collector has therefore to be a highly absorbing, well insulated body capable of being exposed to high intensity radiation particularly in the short wave length band (below 1.3 μ) and low emittance in the infra red band (beyond 1.3 μ) and falling under classes —flat plate collectors and focussing collectors.

Since collectors are the basic elements of all solar systems, it is necessary to embark on a co-ordinated programme of collector development and testing. A certain degree of standardisation is also necessary through collector design that can be tailored to suit individual applications. Presently flat plate collectors are limited to operating temperature range of 70 — 90 C. This range is sufficient for many applications in heating and cooling, but efficiencies obtainable are rather too low for applications like pumping, power generation.

This collector technology is however simple because no tracking is required. Besides both diffused and direct sunlight are utilised with good advantage. For attaining high temperature, however, focussing collector sytems are undoubtedly the answer, but they require good quality reflecting materials and tracking. These complicate their use and enhance the cost.

Another possibility for attaining medium temperatures is by selectively coating the absorber plate. Electrochemical multilayer or graded coatings like black chrome, black nickle, lead sulphide etc. have all been experimented with varying degree of success. Semi conductor selective plants using infra-red transparent binders have also been tried. Cost of coatings, stability and service life are the main problems to overcome in this case, before they can be viable under practical conditions. Optimum combination of selective absorber and window characteristics using indium oxide plus tin oxide can result in higher efficiencies, but here research is needed for further investigations. A great deal of testing will be needed to procede the final development. Also extensive test facilities are needed to assess the performance under different environmental conditions.

In application of solar energy for drying, the customery technique of spreading the material, paddy or leaves on platform with no pretreatment often leave products of inferrior quality due to lack of watch over the rate of drying. Larger systems invariably require use of external power source like operating fans and blowers as in withering troughs of tea industry. Large solar grain driers are particularly well suited to centeral and state farming and to co-operatives. Small scale drier applications can be of radiation types in form of small cabinet driers with product kept in trays inside. Convector driers also lend themselves to large such applications. The controlling factor in convection driers can well be the limiting rate of vaporisation of moisture in the material. Cost wise it is best to achieve maximum drying rate.

Work on the development of solar energy is still in the stage of experimentation and making of prototype in U. S. A., France and Japan. The reciprocating engine tested at Auroville, the rotary engine experimented at NPL, and the immiscible organic—fluid-pressure system development at BITS have encountered technical problem that have delayed field trials. India needs further work too.

FLOODS

By

Prof. GEORGE ALEXANDER B.Sc , B.E , M.Sc., F.I.E., M.I.S.E ,*

&

K. ACHUTHAN, B.E., (Hons.), M.Sc. M.I.G.S., M.C.S.I.*

Introduction

Floods and droughts, cyclones and typhoons, winds and rain, bitter cold and extreme heat—are but some of the elements which are known to have ravaged the earth and its inhabitants over the many millions of years of their existence.

Man has always been fighting against floods, achieving some control over them at some places, or meeting failure at other times. The problems that floods present are so many and so varied that no single measure devised by man can solve all of them.

What is flood

A flood, in the popular meaning, is an irruption of water. Floods are caused by heavy rainfall somewhere in the catchment of a river near to, or far from, the site of the irruption.

The term 'flood', as used in a technical sense is defined as the irruption of water into land that is not normally under water, from which it follows that "flood prevention" means confining the runoff from rain within definite boundaries by means of dams and barrages, drainage channels, river diversions, heightening and riveting river banks. and improving coastal defence works, with such subsidary works as may be necessary, including weirs, spurs, groins, river walls, etc. (Briefly, one may say floods are like dirt, "matter out of place").

Flood disasters come in two phases. When flood waters hit a city the first battle is one of survival, and the protection of life and property. After waters recede, a second fight must be rehabilitate public works, industry and private property.

Flood Problem in India

The flood problem of India is an age-old one. On an average nearly 77,700 to 1,03,600 sq. km of area are liable to inundation due to floods every year, i.e., as much as the area of countries like Hungary, Austria, etc., and larger than countries like Ceylon. The flooded areas of India are nearly 3 percent of the area of the country, i. e., 31,52,030 sq. km. The twin problems of floods viz ; inundation and erosion are common to almost all flood—prone States of India. The kind and degree of damage, however, varies in different regions.

The rivers of India can be classified into three groups, from the point of view of flood occurrence. These are the Himalayan

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rivers, Central India rivers and the peninsular rivers. The flood problem is acute and recurrent in the Himalayan rivers, which include the Ganga and the Brahmaputra basins. The gradients of these rivers are steep in the upper reaches and they carry a large amount of sediment which is deposited in the plains, leading to meandering ways and shifting of courses in many cases. The region traversed by these rivers is also subject to earthquakes and landslides. The Tapti, Narmada and the Chambal are the main rivers in the Central India system while the peninsular rivers are the Godavari, Krishna, Pennar and the Cauveri. Heavy floods in these rivers have been occurring only at long intervals and the flood problem is generally not serious.

Nearly 60 percent of the flood damage in the country occurs in the regions served by the Himalayan rivers. Damage from cyclones and heavy rainfall is as much as 40 percent of the total. In the peninsular region most of the damage is due to cyclones, whereas in the Himalyan region two-thirds are by floods and one-third by heavy rains. In the central region, damage is least, mostly due to floods in the rivers.

Types of Flood

There are two general types of floods. Flash floods affect local areas. Very heavy rains, in a short period of time over small local areas cause these local flash floods. The other general type brings water from distant places that has accumulated to a great excess over a long period of time. Most floods affecting India are a combination of these two.

Cost of Flood

The cost of flood to a community includes these principal items ;

1. Loss of human life ;
2. Danger to public health ;
3. Damage to movable property ;
4. Damage to immovable property ; and
5. Intangible losses, such as disruption of business and transportation.

An accurate and timely forecast of an impending flood should eliminate the first : materially reduce the second and third ; to some extent reduce the fourth by providing an opportunity to protect the less vulnerable areas ; and help to decrease the fifth class of damage.

Floods—Boon or Bane

Floods are indeed both a boon and bane to the part of the country affected "Boon", in that, large quantities of water are made available for agricultural, industrial, power and navigation purposes ; and all life, being supported by water thrives thereby ; while floods prove a "Bane", when they are heavy and being damage devastation, ruin and untold misery in their train to the entire populace, their cattle and their properties.

Conclusion

The modern sciences of Meteorology and Hydrology make it possible to determine with fair precision the kinds of storms a region can expect, the volume of water that may fall as rain, and the rate of speed at which it will descend from the hills and mass itself with its titanic forces in the flood plains below. Engineers can determine the areas the water will cover. The only element of conjecture in their analysis is the timing.

'hese great floods can come at any time ; ·ithin ten years or not for a hundred years.

They may come this year and next year oo.

With these great sciences at our :ommand, we must not limit our flood lamage avoidance programes to control neasures alone. Modern scientific methods :an help guide the surging growth of urban ıreas to grounds that are safe from floods ; hus, the flood problem can be remedied in arge part by keeping people out of the pathway of waters. As foresters have learned to exert their primary efforts towards preventing fires, rather than suppressing them once they have started, engineers can educate India to this new truth with respect to floods—that flood damage *avoidance* goes hand in hand with flood *control*.

Efforts are being made in several countries to make clouds drop their rain as and where required, but such efforts still have haphazard results. Till rain cloud dispersal becomes a possibility, floods will persist.

Construction Management

By

D. K DAS, C. Eng. (Ind.), M.I.E., M.I.S.E.

This paper deals with the procedure and functions necessary for effective management and planning for a construction project and also responsibilities involves for construction management engineer regarding financial investment and business management.

Introduction

In the context of today's specialisation, engineering as we understand has changed to a greater extent. Need for a change in outlook of certain particular functions in completing a project is essential. Modern organisation and management demand a more thorough consideration and knowledge of all their functions. These can no longer bypassed in a superficial manner with the idea that, the requirements can be identified and met at time. Today, on work of any note, all awarding agencies are insisting on firm evidence in written form substantiating the contractor's ability to meet all involved time/cost factors. Organisations planning on entering foreign fields of construction will need to familiarise themselves with occupational classifications and functions, as they are entirely different from that of in India.

Occupational Classifications and Functions

Contractual agreement may involve in the construction, remodelling, alteration,

repair or maintenance of buildings, hospitals hotels, bridges, dams, locks and canals, roads, tunnels, water and sewer systems and other structures or facilities. When the work is not limited to a single trade it is not possible for an individual to manage and direct in the direction of construction at the site. It becomes necessary to engage a specialised representative to supervise a particular type of trade. These supervisors are not concerned with the professional aspects of programme, planning, design development, research and budgeting. Diploma holders In engineering may be engaged for this type of work as supervisors.

Construction engineers, are field engineers they are meant for actual construction operations, they make their engineering decisions and recommendations after close observations of the work, their main interest lie in prosecution of the work. Graduate or professional engneers are suitable for these posts as they will have to take important and vital engineering decision and give recommendations.

Construction managemnet engineers are office engineers they may be engaged at the project site office or in headquarter of the organisation far off from the site may be in some foreign land. They are primarily concerned with the construction administrative and management responsibilities. Their decisions and recommendations are usually made after the inspection and analysis of reports and contract document and consultation with supervisors, field engineers and others. Experienced construction engineers with specialised knowledge of modern management techniques and engineering economics are suitable for this vital post.

Operational Activities

Construction management functions volves under broad heads

1. Collection of design data
2. Preparation of design report
3. Preparation of drawings and estim
4. Planning and scheduling
5. Budgeting
6. Cost controlling

Constructional work including everyth from original design to final job completio the first requirement is to secure the bas design data. To have the design da preliminary tasks involved are site surve soil exploration and soil testing.

This will usually be accompanied by budget estimate of cost broken down onl to its main items, keyed to the major func tions or processes.

Design report consist of design data, flov sheets and financial budgets can be prepare by the research and process design staff.

From the informations in design report working drawings and specifications can be prepaped. The vital and important task of this part is to take a decision in finalising the design so that it ensures maximum eeonomic possible amongst the alternatives choice.

Use of Critical Path Methods in preparing Project Proposal

In cases where the project completion time is specified in the contract, critical path methods are useful in determining a project plan which will meet the time specification. If the proposal requires consideration of alternate completion times and costs, time-cost trade-off procedure may be adopted to

rrive at the project cost. In this method is assumed that the resources may be men, machinery or materials can be measured or stimated, reduced to monetary units and ummerised as a cost per unit time. If the project is to be excuted with a fixed set of resources, then multiproject control may be adopted. This type of analysis will enable the management for taking a decision whether or not to submit a bid on the proposed project because of profit margin.

Implementation

Implementation of critical path methods involves

(a) Planning (b) Initial Scheduling (c) Analysing resource utilisation and time constraints (d) Final Scheduling (e) Controlling

The implementation of network planning and control techniques should take place after a preliminary study has been made to determine how the project tasks are to be broken down and assigned to key personnel.

Project Control

Once a project is underway, the critical path network and schedule shouid serve as a guide to the accomplishment of each activity in proper sequence and on schedule. However, in almost all projects, the activities will seldom start or finish exactly as scheduled. Therefore, updating the plan and schedule is an important task in the critical path concept.

Functions required regarding updating the schedule alone without cost revision are.

1. denoting actual progress on the network
2. revising the network time estimate of uncompleted activities
3. recomputing the basic schedule of earliest and latest allowable times
4. revising the scheduled activity start times and denoting new criticaj paths

Progress Notation

Supervisors close to the actual progress of a project can be assigned the responsibility of marking progress notations directly on a copy of the network. It is necessary that both the actual start and the actual finish of each activity be recorded.

Revised Scheduling

Scheduling computations may be on a reproducible print of the network, instead of the original tracing, Recomputation may only be necessary every time a network is updated and/or revised. This can be done by the forward pass method at the last uncomputed activity on each path. If the actual progress and expected future progress are very close to the network schedule, there is no need to make a completely revised computation.

Financial Investment and Business Management

The basic purpose of studying economics is to determine either the manner in which a given sum of capital can be employed to secure a maximum return in the form of interest or the manner in which a necessary task can be accomplished at a minimum cost. Problem involving economic choice that arise in engineering economics and business management, a decision is required regarding the size or quantity most suitable for a particular asset or process. This is

important because when an additional units of labour and capital applied to a given enterprise, a point is eventually reached beyond which the returns obtained from the additional investment become progressively smaller. Engineering is linked to finance also by the basic fact that engineering design must be moulded to confrom to the capital available to the owners and also if the project is to yeild monetary returns, to the anticipated volume of these returns. No contracting organisation can stay in business very long without knowledge of its costs and an intelligent control of them. Most common reason for failures is bad management. For a construction management engineer knowledge of finance and administration are indispensable to enable him to assume the rate of business management.

Cost Controlling

For cost controlling the first requisite is a cost code. Decimal system can be used to identify all items and accounts on which expense is incurred.

Cost code, single number, can be alloted for various work classifications under broad head e.g., 1. Concrete.

Cost code two number is required in order to arrive at definite unit costs for various classifications of work. As for example concrete can be broken down into various phases such as

1.1 placing concrete
1.2 finishing
1,3 curing

Purpose of cost controlling are to facilitate further bidding, check actual cost against estimited cost, .enable cost reduction studies and enable time/cost determination in critical path methods scheduling.

Cost control and analysis must start with estimating procedure.

Conclusion

The vital parts of construction management are decision making relating to the economic utilisation of resources and the control required during execution the two essential and significant elements-in the management process. Identification of activities to be performed and the resources required in terms of time and cost have been a parmanent need. The techniques of planning and control have a vital magnitude for objects of achieving efficiency in management.

Sleep Induction-Electronic Approach

By

T. G. KRISHNA MURTHY*

ABSTRACT

Induction of sleep as a therapeutic measure is routine in medical practice. Drugs have been utilised to induce sleep in the case of suffering patients and as a post surgical measure to relieve pain. In case of insomnia and other disorders associated with sleep, frequent drugging led to addiction and further complications. Specialists were on the look out for an alternative methods to induce therapeutic sleep. The electronic approach appears to hold high promise after a decade's clinical experience. This method is safe, simple and economical both from the patient's as well as medical institution's viewpoint. Electroseelp clinics are in vogue in many countries. In India too, electrosleep clinics can be established as part of out-patient services or as a 4 or 6 bed inpatient unit in major hospitals (including district level hospitals).

(1) Sleep as a therapeutic measure is an accepted form of treatment in various branches of medicine to treat a wide range of diseases. Certain inherent drawbacks of drugs to induce sleep led to attempts to explore other methods. Recent advances in electronics and electrophysiology opened up a new approach. The electronic technique is safe, simple and economical. The cost aspects are of particular significance for a developing nations like India. Patients cannot afford high costs for treatment. Medical institutions are not in a position to afford high recurring and non-recurring expenses. The instrument costs about Rs. 1000-00 and needs little maintenance. The longivity is 10 to 15 years. A trained nurse under a competent medical specialist can run the clinic.

(2) The instrumentation needed is quite simple. A mains operated or battery operated unit providing regular pulses of 1 to 3 millisecond duration with variable pulse repetition rate from about 20 to 200 per second. Provision may be made for varying the current intensity and indication of the same on a milliammeter. A unit based on the above namely Electronar has been marketed by an indigenous manfacturer (Associated Electronic Engineers, Bangalore). The user feed back over the last 5 to 6 years usage on selected cases by competent specialists is highly encouraging.

Medical Profession in general is highly

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conservative and is most reluctant to change over or accept new techniques unless fully convinced about patient safety and harmless or neglegible after effects or side effects. The electronic method appears to gradually find clinical acceptance in India. More specialists psychiatrists are begining to utilise the technique.

3) A well ventillated quiet room is an essential prerequiste. The treatment may last from 45 to 90 minutes. Number of sessions range from 20 to 40. Patients may or may not go to sleep during the period while current is being passed. A number of electrode placements have been tried, and they include (a) Eyes-occiput. (b) Eyelids-nape. (c) Forehead-nape and (d) Fronto-occipital-biparietal. During passage of current, respiration becomes deeper and rhythmicity of pulse marked. The systolic drops by 10 to 15 mm Hg and diastolic by 5 to 10 mm Hg. The pleythysomo - graph and oxygen saturation of blood appears to remain unaffected. The EEG shows depression of alpha rhythm and appearance of delta waves. Prolonged passage of current leads to the intensification of high frequency beta waves in the frontal lobes of the brain.

4) From the clinical viewpoint, specialists have reported relief while treating cases of chronic tension or anxiety states with or without reactive depression. Chronic insomnia cases have responded well. Clinically, results have been highly encouraging in cases of chronic anxiety not related to environmental stress. Many psychosomatic illnesses that are anxiety oriented (Brouchial, Ashtama, Peptic ulcer, Hypertension, etc.,) appear to respond well to this therapy. It is also likely to benefit drug addicts and alchoholics. The technique has not been of any therapeutic value in cases of involutional melancholia, severe endogenous or psychotic depression, other brances of medicine have also utilised the technique in selected cases. In general the therapy makes the subject more productive and improves nocturnal sleep. Planned trials and evaluation can lead to the wider utilisation by the profession. One must not be carried away by false claims and publicity. Some recent techniques are ideally suited for India considering the cost aspects. Education of medical profession and public by various media like television (wherever possible), radio, publications will go a very long way in the acceptance and wider utilisation of the technique which can relieve the ailing at moderate costs.

BIBLIOGRAPHY

1. KRISHNA MURTHY T. G. (1977) — Electrosleep Therapy— Review The Clinician, 41, 2, 45-48.
2. KRISHNA MURTHY T. G. (1970) — Principles and uses of ELECTRONAR, 16th annual Conf. Assocn. of Physiologists & Pharmacologists, Dec. 1970.
3. KRISHNA MURTHY T. G. (1973) — Electronic Devices in Mental Health Care. 10th ICMBE, DRESDEN, Aug. 1973
4. KRISHNA MURTHY T. G. (1972) — Electrosleep Technique some observations. 4th CMBES, WINNIPEG, Sept. 1972.
5. KRISHNA MURTHY T. G. (1973) — Sleep Electronic Method of Induction 10th RMBES, BOULDER, May 1973.
6. KRISHNA MURTHY T. G. (1975) — Electrosleep Therapy Mediscope, 18, 4, 125—26
7. KRISHNA MURTHY T. G. (1975) — Sleep Therapy - Elecotronic Approach. Indian Medical Practitioner, 29, 2, 125-26
8. KRISHNA MURTHY T. G. (1972) — Electronics & Psychiatry Antiseptic, 68, 2, 109—114.

Discontinuity in Growth of Science

By
GIRIJA MOHAN SINHA

ABSTRACT

Because the historical process of development of modern science is discontinuous, it did not originate in India. Its growth was discontinuous also in Europe.

In ancient and medieval India chemistry, metallurgy, ceramics, medicine were well developed but as alchemy rather than as science[1]. Mathematics and astronomy were of course developed to some extent as science. Parallel growth of science took place in Greece and Middle East. The famous Buddist alchemist Nagarjuna was active around 11th or 12th century AD but afterwards persuit of science decayed, Ghosh[2] has pointed out that the situation was ripe in India for the emergence of modern system of science based on logic any time from 4th century BC onwards. In Greece the same originated around 3rd century BC and developed further before Christianity. Aristotle, Euclid, Archimedes are some celebrated names of this period.

Various theories have been advanced from time to time in order to explain the failure in the development of modern science in India. Such theories are in short :-

(i) revival of Hindu orthodoxy since around 10th century AD.

(ii) foreign invasion

(iii) lack of stability and of orderliness

(iv) disdain of intelectuals toward materialistic world.

(v) estrangement of the people from the ruling power

(vi) lack of patronage by rulers on science activities.

None of the above theories can, however adequatedy explain the default. Ghosh[2] has propounded the theory that the historical process of development of modern science is itself discontinuous. Its development in Europe followed the same pattern[3, 4]. For instance it originated there in Greece but subsequently there was a long lull in this country. Thereafter fine development took place in Italy. The Italians further added both modern medicine and management science. The Italian renaissance of 15th century AD presented a fine civilization and a new spirit. After lapse of certain time, the same reached English Channel couutries UK and France. Modern science turned in UK into technology, further spread in Europe was fast.

*Girija Mohan Singh is with Central Fuel Research Institute, Dhanbad, Bihar State. This paper was received on January 1978.

The advancement in the field of not only science but also other departments of human activities comes rather in waves in certain periods of time. So the growth is discontinuous. Reviewing the history of growth of modern science in Europe and in Asea including Japan, we find that both geographically and chronogically the process was discontinuous.

The author thanks Dr.-Ing. P. C. Ghosh, Scientist of Central Fuel Research Institute, Dhanbad for encouragement. The views expressed are those of the author and not necessarily of the Institute.

REFERENCES

1. Ray, Sir P. C.: History of Chemistry in ancient and medieval India, edited by P. Ray, 1956, pp. 494, published by Indian Chemical Society, Calcutta.
2. Ghosh, P.C.: Metals Minerals Review, Vol. 16. No.4, 1977, pp. 14-16.
3. Ghosh, P. C.: ibid Vol. 15, No. 12, 1976, pp. 23-24
4. Ghosh, P. C. and Sinha, G. M: Engineering, & Metals Review, Vol. 3, No. 42, 5th Decr. 1977, pp. 831, 833.

NOTES & NEWS

Automatic Assembly Machine for Latch Knitting Machine.

The Mechanical Engineering Research and Development Organisarion, Ludhiana, a Regional Centre of MERI, Durgapur, has designed and developed an automatic machine for assembling various parts of Latch knitting needle. The sophisticated machine performs 25 operations in a co-ordinated manner for the assembly of one needle, The main automatic operations incorporated in the machine are: Feeding of needless, Latch cutting and inserting. Latch pin grinding, pin-putting, pin-cutting and needle collecting. The machine can be adopted for assembly of all types and sizes of latch knnitting needles. The machine has capacity for assembling 20 needles per minute.

Electrolytic Manganese Dioxide.

A 1000 tonnes per annum capacity Electrolytic Manganese Dioxide plant has gone into production in Trivandrum, Kerala in July, 1977 based on the technology developed by the National Metallurgical Laboratory, Jamshedpur,

Vanadium Pentoxide from Alumia Sludge.

With the technology developed by N.M.L. a plant has been set up at Ranchi to produce Vanadium Pentoxide ($V_2 O_5$) from sludge obtained from Alumina industry.

Unique Means for Recycling of Paper Wastes.

R. R. L. Jorhat and Central Building Research Institute, Roorkee jointly have

developed a process for manufacture of low cost fire proof roofing sheets from wastes like street sweepings, straw and bagasse. These are durable and have high strength. Handling and transportation are cheaper and easier as these roofing sheets are not easily breakable unlike asbestos-Cement sheets. The lightness of these sheets will result in considerable saving in the cost of sub-structure of the roof. All the machineries and raw materials are indigenously available. It is expected that the product can be out in the market by the middle of this year.

New Method of Extracting Blood-Clotting Agent

Mr. Ernest Manson, consultant biochemist to the Red Cross Society in Brisbane, Australia has discovered a method of extracting blood-clotting agent by which blood will not clot after an injury.

The Freezing and thawing process, developed by Mr. Mason, takes about 90 minutes. The extracted Factor VIII can be frozen and stored for a year. By this technique 150 units of Factor VIII, an ingrediant needed by haemophiliacs could be obtained from 150 ml of plasma against 70 and 90 unit through previous method in operation.

Solar Town Planned for Australia.

Australia is planning for a Solar Town, which is expected to support a population of 15000 in 4000 homes on 560 ha (1380 acres) will be built at Mount Cotton, under the management of the West Coast group of companies. Development will take 12 years and cost around $ A250,000,000.

New High-Voltage Power Capacitors fr Westinghouse.

Two new lines of high-voltage pov capacitors, indentified as Mark VII a Mark VIII, impregnated with WEMCC a non-chlorinated, non-PCB capacitor flu are now avilable from the distributi apparatus division of Westinghouse Elect Corporation. The Mark VII and Mark VI power capacitors have exclusive desi features which include ;

Corona rings on one of the foil edges reduce foil edge stress.

Internal cradle assembly designed to kee the capacitor internals in place in the ever of a cose rupture.

Both lines of power capacitors are give a power factor test, exceeding the require ments of NEMA CP-1-1976.

Power factor "go-on-go" test at 10 degrees C, rather than at room temperature.

In addition, the Mark VIII is given final d-c overpotential production lin test of 6.25 times rated d-c voltage fo 10 seconds.

For more information, write to Westinghouse Electric Corporation, Westinghouse Building, Pittsburgh, Pa-15222.

Heat-Spotter.

Research Institute of Structural Physics, U. S. S. R., has develop heat-spotter, an instrument consist of a TV like camera and a reproducing device equipped with a screen. All objects radiate electro-magnetic waves in the infrared region of the spectrum, in other words, heat. The heat-spotter from a distance of 100 metres can detect changes of temperature equivalling only 10th frac-

of a degree. The light spots on its en correspond to the warmer parts of the ting object, the dark ones to the colder. n the help of this instrument inspection ipeline will be easier and accidents can verted. This new device also opens up ting prospects in the building indus- especially in improving the quality of k.

bating Negetive Effects of Automobilisation

Traffic safety and the reduction of the city of exhaust gases one today the main blems at automobilisation because on n depends the main thing-human life and lth.

Hydrogen may be used as a fuel for the power industry because during its combustion thrice more heat is released as compared with oil products and four times more as compared with cool. Hydrogen is 10 times lighter than petrol, but the main thing is that it is harmless.

Experiments along this line were made in U.S.S.R. and it has been observed a five percent hydrogen additive reduces petrol consumption by about 30% and removes all harmful omponents from combustion products. Special commission of the U.S.S.R. Academy of Sciences are co-ordinating studies into the use of hydrogen Fuel conducted in several cities of the USSR. Scientists belive that hydrogen auiomobile can be produced within the lifetime of the present generation.

Society Notes

Personal

Sri. A. V. Vardhana, A.M.I.S.E. has been awarded vishist seva Medal (VSM) by Rastrapati on 26th January 1978. Mr. Vardhana is with Indian Air Force.

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4. Mathematical terms, abbreviations and Greek Letters should be legible written clearly differentiating the capital and small letters. Superior and inferior symbols.
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- Incorporated on August 6, 1934, it is in existence for 43 years.
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- It now offers membership to respectively qualified persons in seven categories: Fellowship (F.I.S.E.), Membership (M..I.E.), Associate Membership (A.M.I.S.E.), Licentiateship (L.I.S.E.), Associateship (Assoc. I.S.E.), Graduateship (Grad. I.S.E.), and Studentship (Stud. I.S.E.).
- It has on rolls nearly 4500 members within the country and all over the Globe including Bangla Desh, Burma, Ceylon, Singapore. Malayasia, Middle East and African countries the U.K., U.S.A. and West Germany.
- It publishes a Monthly Journal, "SCIENCE & ENGINEERING", from 1935, commanding a circulation throughout the world.
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- It conducted Postal Coaching for sometime, also a Refresher Course for Electrical Supervisor's Certificate examinees.
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- It of late has urged and brought to the notice of the Government the need for National Engineering & Technology Policy.
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- It has on its record the association of eminent personalities like Bharat Ratna V. V. Giri, Late Sir C. V. Raman, Dr. Kailash Nath Katju, Dr. J. C. Ghosh, Nawab Zain Yar Zung Bahadur, Prof. Bhim Chandra Chatterjee, Dr. B. N. Dey, Air Vice-Marshal Harjinder Singh, Dr. J. N. Basu and Engineer - Administrators like Dr. K. L. Rao, Dr. T. Sen, Sri T. R. Gupta, Sri P. C. Bose, Sri P. C. Mitra, Sri S. S. Mukherjee, Dr. K. R. Chakravorty, Sri U. P. Mullick, Sri N. Chowdhuri, Sri H. D. Bhowmick, Sri N. N. Chakrabarti, Dr. H. N. Sethna, Dr. R. Ramanna, Sri S. Samaddar and of leading industrialists like Late Shri R. L. Kirloskar of Yantrapur, Mysore, and Shri G.D. Naidu of Coimbatore.

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Tea Industry in India and Tea for Everybody

According to Reay Tanna hill tea was first introduced into the world market from Japan rather than from China, specificallaly to Holland and Portugal round about I610 A. D. But till the end of 1860 China supplied about 96 percent of total world cosumption of tea. The proportion has however dwindled and figures available for I976 show Chinese exports to have been a mere 62 millon kg. out of total world export of 750 million kg.

The first tea bush in India was planted by Assam Tea Co. Ltd. in 1832 at Charaided and Nazira, in Assam. Since then India has taken a large share in the world production and export of tea. According to 1978 statistics, the export earning of Indiafrom tea was Rs. 228.1 crores in 1974-75, Rs. 236 8 crores in 1975-76, and Rs. 290.0 crores in 1976-77. Definitely the Tea Industry occupies a very prominent place in Indian industry and trade.

While the per capita consumption of tea in England at the turn of the 18th century was about 0.92 kg. in 1915, today the figures for the English market has risen to 4.6 kg. This however does not give scope to any complaceny. The consumption of tea in China, at present, is only estimated at 0.4 kg. per capita, and Indian consumption of tea is also not high.

The consumption of tea in India, although it has now reached the remotest villages, and is a part of daily item of food and beverage consumption, is partly restricted due to high price of tea and due to heavy export. Considering the growing popularity of tea in India, the home market is being starved of tea, not to speak of good tea. The President of the Siliguri Tea Association has estimated that the production of tea in India should increase by another 65 million kg. if it has to serve the home market adequately. While India has been producing one of the finest tea in the World against severe competition from Ceylon and the Africa countries, and has marketed aboard selected specimens of ted around 1975-76 at round Rs. 250/- per kg. in England and which resold at Rs, 350/- per kg. in the West German market, and

Darjeeling Tea in 1976-77 has sold at Rs. 280/- per kg. aboard from M/s. Mac Neill and Magor's Gardens at Soom, and the Company's Assam Tea from Keyhang, Kondoli, Behora, Kotalgurri, Boroi, and Corromora and Darjeeling Tea from Soom and Lingia have been one of the finest fetching high prices abroad, the average tea sale prices at Indian auction have been steady at low bulk prices, and tea is available at home market at anything around Rs. 14 to Rs. 26/- kg. With all round price indexes of all commodities going up annually due to the large plan investments, and World market condition, it is surprising bow. Indian tea for the masses have been able to adjust itself to domestic condition and able to keep its prices comparatively down.

But production of additional 65 million kg. annually by the end of the century or earlier so that the Indian masses have at their disposal more of their daily tea both from view of rise in consuption and quality in the home market, will mean planting of tea by acreage and mordernisation of the tea Industry. Not all the tea companies of India can be said in this respect to be able to fulfil the condition required for the same. A recent directive by the Reserve Bank of India requires that all tea companies like other industries in the public or private sector should maintain a correct asset register. It has been further recommended that a pool of development fund should be set up for the industry, so that it can effect development and mordernisation. But one of the impediments to larger area of planting has been that the State has enquired most the so far unplanted tea areas for resettlement of refuges. The position in the tea industry is not so acute, that most tea gardens now have little surplus acreage for additional tea planting while only a few gardens may be lucky to have 150 hectares surplus after providing for tea sections, factory and building areas and bamboo bari and nursery. Many have barely 8 to 10 hectares left. Some have even less. Hence for increasing the production of tea leaves, only refilling can be done along with replanting. But replanting takes 3 to 5 years for the bush to grow and be ready for plucking leaves. Hence high yielding varieties of Keyhung, TV1, TV11, TV18, and other type of Toklai varities are being used. Maximum processed tea out of Darjeeling Garden is 900 kg. per hectare, and 1400 kg. to upto 2600 kg. per hectare for Assam gardens as in Keyhung.

As regards modernisation for most of tha proprietory gardens, capital is scarce. For the larger well managed sterling capital and rupee capital gardens in the public limited companies in the private sector, the position is some what happier. Here the profits of the companies particularly profits of the bumper year of 1975, to 1977 are being ploughed back after Payment of taxes to modernisation of the tea factories and improvement of the garden, purchase of tractors, pesticide, equipments and fertilisers, sprinklers are being increasingly used in some gardens.

A close inspection of 55 Tea factories in Assam and Darjeeling shows, that in respect of mordernisation through mechanisation the larger stable companies

have of themselves taken up phased programmes for modernisation of the machines, motorisation in place of line shaft working, and conveyorisation. Annually certain Tea estates of a Company, either by rotation or by selection from other criterions, are being selected for modernisation. While in some Tea factories, the factories are being extended, as at Bordwi, Behora, Behali and at others steps being taken for increasing space for rollers, and driers, and withering troughs, certain selections like rolling section, drying section or sorting section, or trough section are being annually conveyorised for greater convenience and economy in production. The present tendency is to motorise the entire factory, eleminating line shafts, to provide for grid power supply, and arrange for stand by power generation capacity and to put up trough in trough houses, either single open type or double enclosed type, in place of the old leaf houses or open air withering houses. Improvement in fermenting section has been taken up by changing over from the old tiered system to either humidity controlled floor drying system or to 'Gumla' system fermenting lines with humidifiers and hot air blower fan arrangement. The withering troughs are being fed from hot air sloves run mostly by diesel oil, and only a few by coal, and sum by gas where gas lines are available as in upper Assam side. The driers are also now being mostly converted to two-stage and are run by Diesel (T.D) oil, or by gas where available, and by coal wherever it is found that working by coal is economical.

The tendency in modernisation is thus to motorise, and mechanise and conveyorise, with use of mono rail for carrying tea leaves to trough houses, right from the first point where tea leavs are brought for weightment and feeding into the factory to the last stage of sorting and packing for despatch. Another tendency seen in the larger tea estates with production of 1 3 to 1.4 million kg. of processed tea annually is to combine two or three fuel tea gardens into complexes with a central expanded processing tea factory in one of the gardens and feeding of tea leaves from the other one or two combining gardens. As a result the annual output of the complex is expected to reach about 30 to 35 million kg. of processed tea, centralisation of production, administration and better management of the tea garden sections.

However, one of the problem, that will continue to confront the tea industry in the years to come will be further popularising tea, in areas or countries where there is likely tea consumption.

Such an important country is the United States of America. Here due to advanced economy, time is so valuable that there is barely time to waste on preparation of the tea in tea pots in conventional manner. Hence the need for 'instant tea'. While there are already 'instant tea' making machines in USA, its larger use at comparatively low cost of the machines is necessary. Besides consideration can be given to its introduction in other tea consuming countries and potenlial user countris

of higher economy as well in low-income countries. Stress can be given by the Indian Tea Board not only to export of Tea but to research in low cost production of 'Instant Tea' slot machines, and to production of cubes like sugar cubes of tea, leaf cubes, dry milk cubes and quick boiling water arrangement under process of cubisation of the ingredients of tea pot tea making that can save much in freight charges overseas and over heads, and transport charges, and increase the carrying capacity due to containerisation on a more condensed scale.

The day may not be far distant when the Indian villager in a remote Indian village may be come busy enough with his powered cottage and small industries, and 5 or 6 crop agriculture, not to find time for an easy going time on brewing and drinking a cup of tea, but would like to put a 25 paisebit in an 'instant tea' slot machine and get his hot 'instant tea', at any time from the way side stall for the asking.

Need to Develop Focal Villages

By

B. B. JOSHI,

C.E., F.I.I.R,A., F.I.S., F.I.V., M,I, Struct E.

M.S.E , (Lond.) M R.I.P.H.H. (Lond,) M.I.S. (India), A.F.M.I,E. (India)

A focal village in a cluster of five villages may be developed for intensive growth work. The first and foremost task is to encourage agricultural entrepreneurs to employ available labour and thus to assits in reducing the trend of rural to urban migration. If the incentive is great enough, the farmer may be willing to provide suitable housing facilities and a reward for effort inducement within the wage struoture to attract labour that ought otherwise prefer to work in areas other than agriculture.

An investment allowance should always be dependent on field and production performance. Whatever investment is undertaken must yield results—Any investment allowance should apply principally to the introduction of new crops and food crops with new and adaptable technology in small and medium sized agricultural enterprises and the establishment of agro-based enterprises (enterprises using local raw material).

Commercial Banking help.

Each State Government should persuade the commercial banks to adopt focal villages covered under its ambitious rural integrated development programme.

*B. B. Joshi, Structural Engineer & Registered Architect, Amritsar

This paper was received on December, 1977

In view of big dificit in each State's finance, a massive dose of banking institutional finance for the development of focal villages is required. About Rs. 30 to 40 crores are needed soon in medium sized states to put the scheme in full gear. It would have been implemented earlier to generate new employment opportunities in the villages to reduce influx to urban areas. Both the nationalised and Scheduled Banks may be asked to adopt villages for development in relation to the deposits held by them in each state. All deposits of the State Government, various Corporations, Semi-Government Bodies, Universities, local Bodies, Improvement Trust, Roadways etc. should be taken into consideration for this purpose to boost the scheme.

Only those banks, which would render suitable help to the rural masses to improve their economic let should be entitled to receive deposits from the Government of those States. It is people's money, which should be utilised for promoting economic development, therefore it ought to be invested in schemes aimed at their welfare.

State Government Initiative

With the branch of bank to meet the credit requirements of the villages, the Government should provide a retail center

for agricultural goods for major farm inputs, such as fertilizers, weedicides, pesticides, machinery and tools with a bulk purchasing concessions, an agro-service station, a fair price shop, a diesel cum-petrol pump, a post office, public call office, and a veternary hospital. Besides civil dispensaries, schools with better facilities, community centres, balwadis (Model Schools) with play grounds and some other provisions for further expansion, as those villages with envisaged schemes are likely to merge as small towns in the years to come.

The programme will provide gainful employment to the un-employed to undertake diversification of agriculture and to set up cottage, agro-based and small scale industries in the selected villages. It will bring about a revolutionary increase in production and improve the economy of such villages.

The new schemes aim at ameliorating the lot of people in villages, To get the desired results, it is imperative to ascertain the local skills, availability of raw materials tracts of land and to keep the views of people in each village in mind before launching the scheme.

Boost of Farming

To ensure the maximum development of agriculture, the consumption of fertilizers to be enhanced for regular supply to the farmers. Soil testing arrangements should also be intensified. A crop plan for every farmer, should be prepared to help him to raise production. The lining of water courses should be done on a priority basis to stop seepage and wastage. The tube wells may be installed, with guaranted supply of electricity on concessional rates.

Job Avenues.

To generate employment and raise production, cottage and village industries may be promoted in those villages after conducting proper surveys. The state Khadi and Village Industries Board may be persuaded to help villagers to take various schemes in hand.

The scientific diarying may also be promoted. The farmers, especially the educated unemployed should be encouraged to keep quality breeds of buffaloes and cow herds. All financial assistance and technical guidance should be arranged for opening dairy farms. Cross breeding and artificial insemination ought to be undertaken for white revolution. Besides, the efforts should be made for the promotion poultry farming. Persons desirous of keeping 100 or more birds may be given technical and financial assistance. In addition to above, fish and pig farming would help in strengthening the economy of those villages.

Precautionary Measures.

The large enterprises must not be permitted in big cities. During the last 25 years heavy industries were allowed to be established in cities because of the availability of the requisite infrastructure and the economies of collective management. This accentuated the existing economic disparities and led to lop-sided development. True, the selection of sites for big ventures depends upon several factors—the provision of rail sidings, easy availability of labour and raw materials and of such basic facilities as power and water. But, if the cities, where such facilities exist are always given priority for new industries,

the undeveloped areas will never get a break through and the congestion in certain regions would consequently become worse, creating a host of social and economic problems. A shift in policy has therefore to be made at some stage to promote economic justice and the present time is quite appropriate in view of the Janta Government's commitment to shift the emphasis to the development of smaller towns and villages and thus to ensure more employment opportunities.

Conditioned Air in Textile Mill in Modernised Way

By

B. K. LAHIRI *

Since ages our country is considered to be "Mother Textiles". However, as days passed, the Textile Industry, with the advancement of Science, has also advanced. More and more techniques are being modernised. With the progress of modernisation in the textile Industry the subject of "Humidification" which has been of interest and importance in the Textile Industry for the past many years, has now been achieving the new concept of "Industrial Air Conditioning in the Textile Industry". The Industrial Air Conditioning includes "Humidification and also the maintenance of temparature by cooling or heating, thc comfort conditions by ventilation, maintenance of normal pressure for human comforts, assisting in maintaining cleanliness in the department creating uniform conditions at the working level in humidity, temparature cleaniliness etc., and controlling the entire equipment in such a was that the above conditions do not vary much even with the changing conditions in the department or outside. The new ideas of Industrial Air Conditioning envisage all the above, and the demand is so great that it would be worth considering whether and to what extent the Industrial Air Conditioning the above sense could be achieved.

During the war and after, the textile spinning and weaving machinery has had very wide changes. The new machine include ideas for high drafting, larger packages, higher speeds short processing etc. for achieving better efficiency and performance in the process, with reduced labour cost and with better production, in quality and quantity. Most of the new developments necessitate higher power requirements, for example, a 400 spindle ring frame in the pre war days consumed approximately 6 to 7 HP and could be driven by a 7.5 HP/ 8 HP electric motor. A modern

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This Paper was received on October, 1977

ring frame of around 440 spindles, with super high draft system, large prckages of 8" lift and bigger diameters, with ball and roller bearings, running at high speeds, with pneumafil arrangement, may need a 12.5 HP electric motor. With larger power consumed for the same area occupied by the machines, the Industrial Air Conditioning Installation has to meet with higher cooling demand, and should have a higher cooling capacity. This naturally increase the needed changes.

The Textile Machines now incorporate more of pneumatic deliveries. This is particularly so in case of blow room installation, where number of machines have pneumatic exhaust and or deliveries. The ring frames have pneumatic broken end suction and collection arrangement, and so have the modern winding machines. The trend is on the increase. These pneumatic suction and delivery machines draw the normal conditioned air from the department of various points and deliver comparatively warmer air at the delivery and in the department, if not arranged for definite exhaust. Such delivery and exhaust arrangement on the textile machines tend to create for more uniform conditions, which the Industrial Air Conditioning Installation has naturally to take care of.

The moderisation of the process needs the maintenance of better cleanliness in the department, by the removal of the floating fluff, dust and dirt, as the same is likely to distrub running of the process by higher number of thread breakages. This is an utmost necessity in case of automatic or semi-automatic machines and processes. The Industry looks up to the Industrial Air Conditioning Installation to assist in developing and maintaining cleaner conditions in the department by removal of the floating fluff, etc. This is best achieved by suitable exhaust arrangement, which also helps in relieving the pressure in the department, caused by the delivery of a large amount of conditioned air by the Installation.

The modern tendency in factory building construction is to go in for box type buildings with flat roof and fewer number of windows and doors. The flat roof or the false ceiling with or without insulation has been considered better from architectural point of view, and at the same time helps in obtaining better results for Industrial Air Conditioning. However, the natural exhust of the supply air to the department is considerable reduced, and unless alternative means of exhausting the air has been achieved, the pressure created in the department would be considerable high for human discomfort.

With the continuous modernisation of the Textile Industry and with the new ideas developing continuously, there has been an increasing tendency of the consideration of Industrial Air Conditioning Installation that could be more conveniently modified to cope up with any new changes in textile machinery modernisation. The Industry, therefore, looks up to a more flexible system which could be modified according to needs. The machinery and equipment for Industrial Air Conditioning has been fully alive to this point, and more and more manufacturers in the States, as well as on the Continent are now developing the unit system, including miniature Air Washers with capacities ranging from 10,000 CFM to 40,000 CFM.

This could be suspended or installed on walls or fixtures at any place in the department.

For designing an Industrial Air Condition Installation, the first consideration of the heat loads and the cold loads. The heat loads primarily are of two types. The first one is the internal heat load consisting of the heat generated by the electric motors and the machines, the heat generated by the electric lights, the heat generated by personnel working in the department, and the heat generated by any other source of steam, electricity or other-wise. This heat load is more or less constant as long as the department is working, except for any stoppages. The other one is the external heat load due to solar radiation transmission etc. This is a widely variable factor which is maximum during summer afternoon and minimum during winter nights. This external load not only depends on the atmosphereic conditions of the location of the factory but also on the construction and the type, of building. The heat load during winter days and night, may be a negative one. Cooling the department to an extent which would absorb some of the heat internally generated. This variation would be the maximum for the north light type of building with asbestos or G.I. Sheet roof, while it would be minimum for flat roof or false ceilings with insulation and having the minimum number of windows and doors. The variation is continuous, not only throughout the season but throughout the day and throughout each hour. Accordingly the resultant heat in the department is continuously changing day to day and hour to hour, variation being the minimum will properly constructed box type buildings. The variation in the outside conditions also iucludes the variation of the humidity in the atmosphere, which also changes continuously with the breakages wind and several other reasons. The Industrial Air Conditioning Installation is normally designed to meet with the maximum heat load from all various sources, and to introduce an extra amount of moisture to supplement the atmospheric moisture to an extent or to maintain the required humidity in the department at the required temparature. The plant, therefore, would have the cooling capacity to meet the above heat load and the supplementary humidity capacity for the above purpose. However, the demand on cooling, capacity, and or supplementary humidification is continuously changing and the plant should have the means to vary the capacity for cooling and humidification to meet the above requirments. The Plant will work at its maximum capacity only during summer afternoon when the outside temparature reach the designed temparature while during the rest of the time of the year the plant should run with comparatively lower load. The same is the case with supplementary humidity which should be less as the atmospheric humidity goes up. During the monsoon days when the outside humidity is comparatively high, there may not be any necessity of adding any extra humidity in the department.

The recirculation of air could be more uniform only provided the points of suction are fairly distributed in the department and are not too far from each other. The unit system is of greater advantage in this resspect. The recirculated air system is also

taken advantage of by providing suitable air filters where an amount of floating fluff could be collected for easy manual removal at intervals. The system would accordingly assist in maintaining better cleaning and more comfortable conditions. Natural exhaust either through the north lights roof, windows and doors, add the crevices at round, This exhaust pressure will be higher when the natural exhaust is more restricted. If the natural exhaust is too high, it is difficult to maintain the conditions of temparature and humidity in the department. If the natural exhaust is too restricted, the pressure created in the department would be sufficiently high to make the internal conditions of discomfort for the workers. A number of Textile Mills have resorted, in such instance to the installation of Exhaust Fans either in the windows or in the north lights thereby achieving somewhat comfortable conditions. The trend in the modern Industrial Air Conditioning system is for considering forced draft exhaust which would be controlled to the extent required the force duff exhaust is also taken advantage of for proportioning the recirculated air through the plant, thereby achieving the reduced cooling capacity of the plant.

It is of interest to see that the points of generation of heat are also the points of generation of fluff dirt etc. The fluff or dirt deposits itself on the machines on the floor level etc. not only starts floating in the departments with the currents of conditioned air but also deposits on the building structure walls roof north lights, the electric fixtures etc. Deposition of the fluff at all the various points needs frequent cleanings, but the deposition of the fluff on the process itself causes the breakages of yarn etc. and hinders efficiency of process. This is of great importance with the modern machines wh are automatic or semi-automatic and whic are designed for working with less labo cost.

The modern tendency with the I. Installation is to supply conditioned a through an arrangement at the top. Th theoretical uniform distribution of the a could be achieved provided each point o the ceiling is the location for supply air. Th is impossible to conceive. For getting th best of the results and commensurate wi the feasibility of supply air system and th cost of the same, the deliveries could b arranged at distance of 30/ to 60/ apart. Th supply air ducts could then deliver cond tioned air horizontally, with regulated vel cities so as to form, more or less, a unifor layer or conditioned air at the top level The conditioned air would normally b around 80°F/85°F with around 85% t 90% humidity, depending on the resultan conditions desired in the department. Th uniform layer of air would descend in th department gradually, and naturally. Th modern installation would also envisage th exhaust arrangement by undergroun system. Once again, theoretically the exhaus should be from each point underground This also is not practical and as suc the exhaust could practically be arra nged by suitable elected points, so tha the maximum amount of heat and the flu could be drawn with the exhaust air. Suc suitable points could be the places neares to the sources of heat generations and flu generation and could be the alleys of heat i the ring frames, and underground gutte under each ring frame. In the loom shed

the exhaust could be more suitably arranged in the ...... alleys the exhaust arrangement could also be connected with the machinery pneumatic exhaust and delivery arrangement. This arrangement would have the positive circulation of air from top of the department to the bottom, with no possibility of the air going upward. The heat and the fluff generated would not only be sucked to maximum possible extent by the underground exhaust, but whatever fluff or heat remains would not its way up, owing to the positive downward current of air. The remaining fluff would then deposit on the floor level or at the bottom part of the machines making the cleaning much more convenient. With a properly designed forced draft exhaust arrangement, there would be very little or cleaning required on the ceiling required on the ceiling, walls, electric fixtures, etc. The undergronnd exhaust would remove in the department and heated up the conditioned air. As the heat is removed from the department the heat load and consequently the cooling capacity for the I.A.C. installation is reduced. The positive circulation of air would create ventilation and better comfort conditions. The downward flow of conditioned air from tip meets with no other heat except for the heat from the roof, and changes but very little, in humidity and temp. till it reaches the level of around 5' above the round. This also created for better conditions for human comfort.

The underground exhaust could incorporate suitably designed filters and air cleaning arrangement, and with suitable dampers the same could be exhausted to the atmosphere during warm summer days and could be proportionally recirculated through the I. A. S. Installation during cooler days or during the monsoon. It is possible that the exhaust cum-circulation arrangement could be automatically controlled through suitable temp. and humidity controllers by action on the damper motors. These controllers are now easily available in the country.

Depending on the design of exhaust arrangement the warm air could be exhausted to an extent as to create more comfortable uniform conditions in the department, which normally could not have been achieved by the supply air.

Such implementation can give very good return and as compared at a very little cost. Our country being pioneer in cotton textile industry, the industrialist in this fieldshould find it worthwhile to install modernised Air Conditioning Plant which would keep the industry "Cold and Hot" as may be technically required. This will improve the quality of product and keep the country's head high in this line. While improving upon the quality, let us give maximum comfort to our men working in plant by adopting only one method and implementing one system only.

Personnel—A Due Emphasis

By

D. B. CHOUDHURY, B.A., LTI (U.K.)

Introduction :

The 'Personnel' function in many Organisation today is either absent or is often restricted to attend Trade Union People or Staff 'Welfare' only. An attempt is made in this article to review the personnel function in its proper perspective.

Placement of frame work :

When we consider the different aspects of an enterprise viz. Finance, Marketing, Sales and Personnel as links of an integrated chain, the importance given to the last aspect is generally far less in comparison with the same given to others.

It is an elementary principle that the success of any enterprise depends on how best it exploits the available three M's viz. Man, Material and Money, We come across many cases where comparatively poor seeing is done in the most important complicated and interesting area 'MAN'.

Starting from the first principles of Personal Management the functions can basically be described as 'Selection' training and motivation towards the growth of the individual and the organisation. How important each function is how best they can be carried out and how soon they can be felt ?—these questions may normally come to one's mind.

Selection and Training :

Planning of Man-Power is a very critical factor in the context of increasing the Output of the Organisation, Improper handling of this subject will stand as a 'Hurdle' all the time to any Organisation. In the time of posting, the essential need for a particular staff does not only mean his designation but Calibre, Skill, temperament and also public relation. Taking only one aspect it is alway desireable to have employees of different age group.

For instance if an Organisation whose main function is to procure Agriculture product in rural area employs a team in a procurement centre where age group of the members are between 25 to 28 only, it indicates that Management has only considered the basic qualification of the member not the Skillness. On the other and if this Management engaged in a procurement members of age between 45 to 55, consideration here would be only experiences not qualification. For this haphazard recruitment this Organisation in both cases would face a position of loss.

Posting or recruitment is basically a process of matching the potential of the

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This paper was received on January, 1978

employees with that of job required by the Organisation.

In most of the Organisations the concept of Training is limited to staff level. In many cases the concept of training is understood and practised as to keep the recruit under fear and threat of losing the job till confirmation. Thus once confirmed the training process is over in other words so long as the new recrquit is on probation he should understand that he is being trained. This is why the moment of confirmation is mostly considered as the moment of relief and accomplishment.

A Govt. Organisation has recruited once about 250 graduate boys as apprentices and arrangeed a training for these boys for one year. This Organisation is dealing with a such trade where working technology is changing day to day and one year is not enough to learn the process for any new comer in this trade. After confirmation no training was offered to these boys by this organisation as a result these boys neither trained fully nor became asset rather became burden to this organisation.

So, an effective Personnel Manager's duty is to make the recruit feel himself that he is expected to contribute to the company's goal. The absence of such feeling indicates the failure of sound personal Management.

Erratic method of Promotion :

Erratic methods of promoting employees effect the organisation in another way by creating frustrated people. It has been observed that non deserving promoted employees have a habit of 'Passing the buck on the others'. Very often executive says as follows :

What can I do over night for this organisation ? My staff is crawling when I set my foot for running. They don't do this deliberately but don't have the legs vigorous enough to run. None of them deserves the post they hold today".

So the dearth of the calibre amongst the staff is the outcome of a sequence of mistakes committed by erratic promotion of non deserving persons. Again why should every one commit the same mistake ? Here the practice and history of errating methods of promoting comes into picture. In this type Non-deserving promotion in a organisation, things are bound to take place in the mort hap-hazard and frustrated way. Is it not a duty of sound personal department to change such a practice whenever the same is diagnosised ?

A Cultured Revolution :

Just as a country, a society and a religion having a culture an organisation also has one of its own. More important than this theory, the fact is that in an organisation different level of workers have got different culture of working. Different functions follows different ideologis. This is a branch of Mangement Philosophy. There are cases revealing that organisation having tremendous potential collapsed due to the congenial condition of 'missing rapport' between different sections. This unity is a must and must be understood to serve jointly for the benifit of the organisation. This is applicable right from the top manager to the shop floor level. Number of trivial communica-

tions, paper works and wastage to time are some of the effects of non unity and lack of understanding about the organisations overall problems. The root cause of such problem is termed as culture of the organisation. A significant though intangible contribution can be made in this area by a Personnel Manager who by his personal ability and sincerity make the worker united and conserve their energy for the benefit of the organisation, No doubt this is a thankless job indicating not any visible development. But the developments are not always necessarily to be seen but they should be felt.

Motivation by Punishment :

Inefficiency is a bad culture a disease which spreads like fire in a forest, it goes upwards and spreads evenly poisoning the whole atmosphere. Employees should be totally clear about the consequence of their inefficiency. No successful organisation can tolerate a situation where such doing and mistakes are taken for granted. An individual should know that he has to pay a price in case he continues to be inefficient. A system which can continuously evalute employees should be developed which will take care of all the consideration in performing jobs. Scales are to be formed where the employee is takes up or down depending upon frequency of his mistakes and damage done to organisation. Such a scientific method serves the following purposes—

(1) Right persons are never overlooked when a situation of reward arises.

(2) An inefficient employee would not throw muds on the authorit[y] which he does in the absence o[f] any proven records showing wh[y] he is not getting only reward an[d] being punished.

(3) Employees will get confidenc[e] that they will not become victim of favouritism and nepotism.

In short the system will increase th[e] moral amongst employees and this is th[e] objective of personnel Management a[s] mentioned before.

It should be conceived on ethical line[s] that an organisation similar to rewardin[g] for effective contribution should also ac[t] suitably in the negetive manner in revers[e] conditions. If an individual employee is going in a wrong path one can possibly correct him by brain-washing sessions. I[f] a group of people are doing so, there are methods as traditional as patronising a rival group for the sake of correcting the former. But if the whole organisatio[n] suffer from such a disease only a well build system would be of some use.

Conclusion :

It can be stated that no successful area in any science has secured its places without development of own activities to fulfil the ever increasing needs. One has to understand the need and the full dimension of it in order to devote one self for the growth of the profession and society. A battle is seldom lost for a warrior who is well equipped and determined to do his best.

"The Obsolete Revolution"

By

SAROJ MOHANTY, M.I.S.E.*

Is it not surprising that it took 500,000 years for the first man to use stone as a tool, to turn into a stone-smith !
Revolution, in industry took rapid strides, thereafter.

It took the next 50,000 years for the first stone-smith to beget the first iron-smith.

In the next 5,000 years the engines were evolved and we get the first engine-driver.

The next stage was swift and in 130 years, the first engine-driver turned into a supersonic jet pilot.

The next 7 years were remarkable, leading from the splitting of the atom to the manufacture of the atom bomb.

Is it not surprising that the human body contains 5×10^{27} atoms, very roughly ! some of which are dying and regenerating themselves, in a continuous process.

Equally suprising is that one cubic mile of sea water contains as much as 150,000,000 tonnes of solid materials, most of which, about 120,000000 tonnes is common salt, 18,000,000 tonnes of Magnesium and 20 tonnes of gold. Harrison Brown postulated that one hundred tonnes of average igneous rock, such as granite, contains 8 tonnes of Aluminium, 5 tonnes of iron, 1200 lbs. of Titanium, 180 lbs, of Manganese, 70 lbs. of Chromium, 40 lbs. of Nickel, 30 lbs. of Vanadium, 20 lbs. of Copper, 10 lbs. of Tungsten & 4 lbs. of Lead.

The celebrated scientific narrator Arthur Clarke said :-

When a distinguished but elderly scientist states that something is possible, he is almost certainly right.

When he states that something is impossible, he is very probably wrong.

Some of the inventions & discoveries were anticipated, while some appeared like bolts from the blue.

Those that were expected are :-

Automobiles flying machines, steam engines, submarines, spaceships, telephones, robots, death-rays, transmutation, artificial life, immortality, invisibility levitation, teleportation, communication with the dead, observing the past & future and telepathy etc. While the unexpected lot were :-

X-rays, nuclear energy, Radio, television, electronics, photography, sound recording, quantum mechanics, relativity, transistors masers & lasers, super-conductors, superfluids, automic clocks, Mössbauer effect, determining the composition of celestial bodies, dating the past (Carbon 14 etc.), the Ionosphere & van Allen Belts etc.

It is difficult to comprehend that T V

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contains 250,000 picture elements and takes 30th. of a second to handle them into proper synchronisation. The speed of light is also beyond comprehension, nearly 670,615,000 miles per hour, which comes to 186282 miles per second, and audible sound vibrates at the rate of 20,000 vibrations per second.

Most of the energy expended in the history of the world has been used to move things from one place to another.

For very short distance, 1 to 10 miles, for local & urban transportation, the evolution from foot went through horse, bicycle, scooter, car, bus, truck, pipeline conveyor & sub-way conveyor.

For short suburban or rural distances ranging from 10 miles to 100 miles, we have car, 'bus, rail, boat, truck, pipelines & conveyors. Over 100 miles to 1000 miles, for medium continental transport, there are, car, bus, rail truck, boat, aeroplane, G E M (Ground-effect-machine), V T O L (Vertical-take-off and landing aircraft).

And over 1000 miles, we have the inter-continental long range mediums :- rail, aeroplane, ship, submarine, GEM, Ramjet etc

Extrapolating into the future, we may have, among other things, personal radio by 1990, artificial intelligence by 2000, colonising planets, global library, wireless energy, sea-mining & sub-nuclear structures by 2010, earth-probes by 2020, Inter-stellar probes, logical languages, weather control, control of heredity by 2030, contact with extra-terrestrials & space mining by 2030, intelligent animals by 2040/2050, gravity control, space drive, memory playback, planetary engineering & suspended animation by 2060, mechanical educator, coding artifacts' artificial life & space-time-distortion by 2070, near-light speed & climate control by 2080, inter-stellar flight and machine device, which will exceed man's intellegence by 2090, matter transmitter & meeting with extra-terrestrials, world-brain and immortality by 2100.

Thus far, Sir Arthur Clarke could extrapolate into the future, but no further.

All our accumulated knowledge will be come obsolete by then.

Articles and Notes are invited by the Editorial Board for publication in SCIENCE & ENGINEERING. Readers Views and Comments will be specially appreciated.

VOTES & NEWS

1. An interesting and informative Panel iscussion on the prasent state of the art f Solar Energy utilisation was held on the 0th January, 1978 at the end of the Interational Solar Energy Congress '77. The 'anel, which was headed by Dr. ·. Ramachandran, Secretary, Department of cience and Technology, consisted of eminet cientists and engineers working in different reas of solar energy utilisation.

2. In recent years there has been a growing worldwide awareness of the potentiality of solar energy for various applications. It is estimated that by 1985, one o two percent of the total energy consumed will be met by solar energy and by 2000 AD this is expected to increase to five to seven percent. However, as solar radiation available and the availability of other forms of energy vary from region, each country will have to formulate its own proposals for effective utilisation of solar energy. Some of the solar energy devices are technically feasible and economically viable even now. For quite a few others techno-economic viability is increasing due to continued research and development. It is however necessary to proceed judiciously in the harnessing of solar energy for meeting various energy requirements.

3. The following are the three areas which offer great promise in the application of solar energy :—

1. Thermal Devices
2. Direct Conversion (Photovoltatic application)
3. Biological Conversion.

Thermal Devices

3.I.1. Flat plate collecters using different kinds of metal absorbers are entering the market. The development of selective coatings, which improve the efficiency of the collectors, receiving considerable attention. Development of concentrator collectors (stationery and tracking types) is also being pursued by scientists and engineers. The immediate need is to reduce the cost of collectors and to increase their efficiency and life.

3. I. 2, It is considered necessary that flat plate collectors and concentrator collectors should be tested under different field conditions. It is also necessary to evolve internationally accepted test procedures for collectors.

3. 1. 3. Agricultural and industrial applications of solar energy using thermal devices are being tackled. Interesting developments in the fields of drying of commodities and pumping of water etc. are reported.

3. 1. 4. Utilisation of solar energy for space cooling and space heating is also receiving attention. Development of successful proto-types in this area would provide inputs for improved and cheaper designs.

3. 1. 5. Solar thermal power systems have been developed in a number of countries. Instend of embarking on large scale power plants, it would be desirable to instal smaller plants in larger number. Fabrica-

tion of bigger and cheaper concentrators is also considered as an important goal.

Direct Conversion (Photovoltaic Application)

3. 2. 1. In the photovoltaic area two approaches are being followed. One is based on the use of silicon and the other on applications of thin-film technique. In the former, an efficiency of up to 15% has been achieved, while in the later the present efficiency of 5% is likely to be improved to 8%. It is expected that by photovoltaic conversion it would be possible to generate electricity at a cost of one dollar per watt by around 1990. If this reduction in cost becomes feasible, photovoltaic application could stand on its own in some cases, while in others it could supplement thermal power plants.

3. 2. 2. Single crystal silicon solar cells are expensive and emphasis is being laid on cost reduction. While the use of poly-crystalline silicon is likely to prove advantageous, one of the ways of achieving cost reduction is through the use of concentrators, which appears promising. Another approach, which is being actively pursued, is on development of ribbon type single crystal silicon cells.

Biological Conversion

3. 3. Enough attention is being given to the development of cheap systems for the production of fuel gas by biological degradation of animal and human waste. Utilisation of solar thermal energy for increasing the temperature of the digestors appears promising. Application of the fuel gas from large size digestors for industrial applications is also receiving attention.

4. 1. Considerable attention is al being devoted to storage of enegy o account of intermittent availability of sol radiation. Low temperature product and short term storage of solar energy a being considerd.

Approaches being followed for stora are :—

1. Storage of heat in the form of sens ble heat and in the heat of fusic salts.
2. Electric storage in batteries.
3. Use of the fly wheel (Mechanic Storage of energy)

4. 2. Long term high temperatu storage devices will require chemical stora and in this area considerable research an development work will be necessary. It ma perhaps be useful to explore the possi bility of the utilisation of hydrogen fo such energy storage.

5. It is necessary to adopt an integrate approach in the utilisation of various no conventional sources of energy. A sugge tion made, which is worth exploring, is th development of hybrid systems based o direct energy conversion and therma conversion of solar energy. Considerin the effort put in by different countries, i appears that solar energy has a fairly brigh future. Efforts will have to be made t utilise solar energy as extensively as possible There is no doubt that solar energy utilisa tion is now moving from the stage o research and development to the stag of field trials. It is hoped that by th turn of the century, solar energy wi contribute significantly to the total energ needs of the world.

SOME HIGHLIGHTS ABOUT I S E

- Incorporated on August 6, 1934, it is in existence for 43 years.
- Its membership is open to Engineers and Industrialists and Technologists, Technicians and Learners alike.
- It now offers membership to respectively qualified persons in seven categories: Fellowship (F.I.S.E.), Membership (M..I.E.), Associate Membership (A.M.I.S.E.), Licentiateship (L.I.S.E.), Associateship (Assoc. I S.E.), Graduateship (Grad. I.S.E.), and Studentship (Stud. I.S.E.).
- It has on rolls nearly 4500 members within the country and all over the Globe including Bangla Desh, Burma, Ceylon, Singapore. Malayasia, Middle East and African countries the U.K., U.S.A. and West Germany.
- It publishes a Monthly Journal, "SCIENCE & ENGINEERING", from 1935, commanding a circulation throughout the world.
- It maintains a Library containing above 2,000 volumes of Books and Reports.
- It has published some technical text books bynoted Member-Authors, e.g. "Building Materials", & "Mineralogy, Petrology & Economic Geology" : Tables (an enlarged Third Edition of this latter work i. e. the TABLES has been recently published by the Indian School of Mines & Applied Geology, Dhanbad.)
- It conducted Postal Coaching for sometime, also a Refresher Course for Electrical Supervisor's Certificate examinees.
- Its ambassadorial services embrace Lecture Programmes, Inter-Society collaboration and exchange of ideas, delegation to national and world Engineering Congress.
- It of late has urged and brought to the notice of the Government the need for National Engineering & Technology Policy.
- It acts as a principal sponsor of the Federation of Professional Engineering Institutions of India (F.P.E.I.I.) cum the Joint Indian Engineering Council (J.I.E.C.).
- It of late has set up a BRAIN TRUST along with Technical Information Department to provide aid and guide to Operational Research and Practice in different fields of Engineering and Technology.
- It has on its record the association of eminent personalities like Bharat Ratna V. V. Giri, Late Sir C. V. Raman, Dr. Kailash Nath Katju, Dr. J. C. Ghosh, Nawab Zain Yar Zung Bahadur, Prof. Bhim Chandra Chatterjee, Dr. B. N, Dey, Air Vice-Marshal Harjinder Singh, Dr. J. N. Basu and Engineer - Administrators like Dr. K. L. Rao, Dr. T. Sen, Sri T. R. Gupta, Sri P. C. Bose, Sri P. C. Mitra, Sri S. S. Mukherjee, Dr. K. R. Chakravorty, Sri U. P. Mullick, Sri .N. Chowdhuri, Sri H. D. Bhowmick, Sri N. N. Chakrabarti, Dr. H. N. Sethna, Dr. R. Ramanna, Sri S. Samaddar and of leading industrialists like Late Shri R. L. Kirloskar of Yantrapur, Mysore, and Shri G D. Naidu of Coimbatore.

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Role of Science & Technology in India
—An Objective Approach Needed—

Inaugurating the 65th Session of Indian Science Congress at Allahabad the Prime Minister Shri Morarji Desai, called upon the Scientific community to relate its work to the immediate problems of the Society and to strive to lift the masses out of the morass of poverty. He offered full support of the government in this task.

Union Minister of Education, Dr. P. C. Chunder in his Convocation Address at the Indian Institute of Technology, Khargpur, also urged upon the Scientists and Technologists to employ science and technology to the benefit of the poor people in our country so as to eradicate poverty and ensure a minimum standard of living for all our people.

Today problems beset every aspect of our national life. Problems for providing food and shelter to one and all, unemployment problem, problem of rapidly growing population and so on. We cannot get rid of these problems overnight or expect that Scientists and Technologists with their independent efforts will be able to achieve this goal either. Government is to play the vital role who must decide and formulate Directive Principles regarding problems which are more important and to be solved first. Prior to independence in our country. Foreign British Ruler had only one objective and function that is to maintain 'Law and Order' to safe guard their interest. The same bureaucracy is still pevailing in the governmental procedure. Scientists and technologists are always behind the screen and are playing only an indirect role in basic decision-making process.

Dr. Chunder has told that the Janata Government has Launched a new educational plan under the new Five Year Plan from this April for adult education, non-formal education and vocationalisation of secondary education side by side with technical education with a view to build a Society where justice and equity will prevail and everyone assured of a certain minimum living standard. We must appreciate that the Govt. has rightly identified the basic needs of our society and is planning accordingly. But at the same time we feel the syllabuses prescribed at the secondary level will not serve any useful purposes except an additional taxation on immature brain. No doubt we will have to chalk out our activities in the context of our future needs. We will have to overcome the deficiencies in the present system. It would be wise and better to form an expert committee consisting of scientists, technologists and educationist who could have effectively plan according to our needs, before finalising the syllabuses. Apart from the syllabuses vocationalisation at the secondary level may altogether prove ineffective if we fail to provide adequate employment avenues for the students completing secondary level and will impose new problems and impact on the society. During the last 30 years since independence we have changed our educational plan a number of times but that proved to be ineffective.

Dr. Chunder has given due appreciation to the scientists and technologists, but blamed them as they are keen to live in an elite world of their own, copy the life styles of the West and generally look up to the Western Countries for their appreciation. This may be true in a few cases but not Scientific and Technological community as a whole. Scientists and technologists cannot be blamed for this. Dr Chunder, himself has admitted the fact that we are not making full use of the high level technical manpower we have, and have not been able to provide adequate opportunities for them in the country. This has resulted not only in underemployment of the trained personnel but also in the export of technically trained persons abroad to the advantage of other countries.

We are sure scientists and technologists are always ready to serve the nation assuming greater responsibilities. But for this we must give them scope for research freedom for work, congenial atmosphere and adequate finance. Very often we come accross from our political leaders that we are a poor nation and cannot afford enough fund for scientists' or technologists' fancy research work. It is true we are poor. But can we not take lessons from other nations who are successful in building up their country that were even worse than ours ? Our leaders will have to be more sincere. They should be more cautious not to take any special privilege at the cost of our poor nation. All of us will have to share all the miseries and hard life with the common people till we are in a position to remove our poverty and upgrade the weaker section of our Society.

We could have achieved better result since independence if our political leader would have allowed the scientists and technologists play the vital role of leadership in planning and implementing the programmes instead of consolidating their own hold on the Society. The modifications suggested by the C.S.I.R. to remove political head and appoint distinguished scientist at the NCST is definitely an encouraging approach and we can expect better use of science and technology in the services of the people.

We fully agree with Dr. Chunder's view that an engineer must remain a student all his life. In fact the Engineering Societies and Institutions are contributing to the nation's developments playing the vital role in the dissemination of the current developments in science and engineering to the practising engineer and technologists, helping in exchanging their views and to avoid any possible pitfalls that they have acquired in course of theoratical knowledge.

As we have said before crisis of the present day human society in our country are multifarious and the real solutions are interdependent. So the approach should be multidisciplinary and universal. The scientific and technological community in this situation is to take the vital role of leadership in planning and implementing the programme for achieving the objectives of new social ethics. We are sure that the scientists and technologists in our country will soon realize the importance of their work in transforming social ethics and overall human welfare and will direct their endeavour and energy in plugging the motive for individual or group profit in future,

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Articles and Notes are invited by the Editorial Board for publication in SCIENCE & ENGINEERING. Readers Views and Comments will be specially appreciated.

RIVERS

By
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Introduction

Man has always had a vital interest in rivers. Early man slaked his thirst at the river's shore and hunted game on the fertile flood plains along its banks. As civilization advanced, man made still more intensive use of the river. Man's dependence on the river has grown until today the rivers exert a major economic and sociological force on his activities. Therefore, anything that might affect the river is of vital concern to him.

Characteristic of River

A river has, in general three characteristics and distinct reaches in its course from the source to the point of its outfall into the sea, viz. the upper, the middle and the lower reaches. In its upper reach it traverses hilly countries and is known as the incised or boulder river according to the characteristics exhibited. At the entry into the plains, the middle reach begins in which the river has no defined course and is unpredictable in behaviour. In this reach, the river is termed alluvial. Further down as she progresses towards the sea, it comes under the influence of new forces tidal in character and hence is known as a tidal river

River System in India

The rivers in India can be broadly divided into four systems, viz. the Brahmaputra, the Ganga, the North West and the Central India and the Deccan river systems. This classification is based on broad regional similarities of the area in respect of meteorological,geological, topographical and the resulting hydrological characteristics of the rivers and their tributaries.

In the Brahmaputra system, the predominent problem are spilling of the rivers over their banks, bank erosion and tendency to change their courses. These rivers carry a considerable amount of silt load which is mainly responsible for their problems. In addition the area being liable to severe earthquakes, the rivers undergo considerable change in their regime ,particularly in rising their beds as a result of earthquakes.

In the Ganga system, the predominent problem is of spilling and changing course particularly of the North Bank tributaries which have somewhat similar characteristics of those of the Bramputra system.

In the North—West River system, there is no major problem posed by the important rivers like the Ravi, Beas, Sutleg etc. excepting that on some occasions they spill over their banks. However, the Jhelum river in Kashmir poses frequent problems of inundation due to its inadequate carrying capacity particularly through Srinagar town and below Wuller lake However, some of the small rivers coming down from the Siwalik hills locally known as choes cause considerable problems by depositing coarse sand over the fertile fields thus rendering them unfit for cultivation.

By and large, the Central and Deccan River systems are relatively free from any major problem, as these rivers are almort stable and have well defined courses. They however, cause infrequent floods in the wake of cyclonic storms particularly during the North—East monsoon.

Out of 1672 billion cubic meters of surface water through 110 rivers available in our country, water resources which can feasibly developed are 666 billion cubic meters while the underground water resource, which can be conveniently exploited are estimated at 260 billion cubic meters. So far, we have hardly used one—third of the surface water potential and about the same of the ground water potential. We have yet to go a long way for making the fullest use of the available water.

Use of Rivers

Rivers are useful as sources of water supply and irrigation ; for the development of hydraulic power , for recreation and as outlets for drainage. If large enough, they may also be useful for navigation. On the other hand, they are liable at times to cause serious damage to property, interruption to communications and even loss of life.

There may be a tendency to take rivers for granted, to think of them as fixed and unchanging, something provided by nature and in no need of improvement by man. Such an outlook, however, would overlook several important facts.

Firstly, even in nature, rivers are active things. They are constantly at work, eroding material, transporting it and depositing it to build up alluvial tracts of land. Within these alluvial areas, they change their courses, gradually or suddenly and so wander from side to side accross the country.

Secondly rivers are naturally subject to the effect of natural forces. Geological action such as volcanic eruptions or earth movements, may block or change their courses and considerable time may elapse before the river, unassisted, can reagain its former efficiency.

Thirdly, human occupation of a country may affect rivers adversely. Man not only settles along rivers and expects them to keep quiet and behave themselves, as if they were domesticated animals, but he also in many ways acts so as to harm the rivers and thus aggravates the effects of which he complains.

River Training

River training may be defined as the process of controlling and stabilising a river along a desired course with a suitable waterway. In general river training covers al

engineering works constructed on a river to guide and confine the flow the river channel and to control and regulate the river bed configuration for effective and safe movement of floods and river sediment. Rivers have been trained in other countries and being trained in our country also. The Rhine in Germany, the Po in Italy, the Mississpi in the United States and the Danube in the Slay countries are examples of trained rivers which serve for irrigation, navigation, hydropower, recreation etc.

Conclusion :

Rivers are said to be the main life-lines of a Nation and hence study and understanding of the behaviour of Rivers with a view to optimum utilization of their waters for various purposes is of great significance particularly for a country like ours and involves complicated problems and complex decision making processes. This fact has been recognised for centuries now. In fact Galileo (1564—1642) the famous Italian scientist of his day had remarked, "I had difficulty in the discovery of the motion of heavenly bodies inspite of their astonishing distance than in the movement of the flowing water before our very eyes"

EARTHQUAKE PREDICTION

By

MANISHI BARANWAL, M.Sc., M. Inst., M.I.S.E.*

Earthquake predictions are presently based on scientific and logical reasons through cases of earthquake predictions are reported even in early days of civilizations based on myths and legends. Even presently cases of earthquake prediction based on myths and legends are not very uncommon. Due to tremendous losses of lives and property, earthquake prediction remained ever a matter of deep concern and of immense use for mankind. Intensive scientific studies of earthquake prediction are presently in progress in Central Asia, Kamchatka, U.S.A, U.S.S.R, and People Republic of China though they were first started by Japan. The results are quite encouraging and prediction made by Peoples Republic of China of Feb. '75 earthquake at Liaoning was one of the major events in the history of geophysics which has come true.

Predictions based on myth and legends might contain some truth though at first they appear to have no scientific reasons The case history of recent earthquake at Liaoning (Feb. 4th 75) gives support to this as will be evident in the following text. These legends will be briefly mentioned below and one should look into the reasons of these legends without being biased.

*Manishi Baranwal is with Geological Survey of India. This paper was received on December '77.

Since medieval time Japanese people believe and accordingly it has reported that prior to an earthquake fish and animals behave unusually, that a mysterios rainbow is observed sometimes, that magnet loose its attrcting power, that weather behaviour becomes unusual etc. Some of these legends appear to have some bases connected with scienlific theories. However it must be kept in mind that people are alive to all kinds of phenomenom observed at the time of severe earthquake and are apt to regard them as something connected with the catastrophical occurrence while they forget to consider that the same phenomena are observed on other occasions not at all connected with other earthquakes.

Some of these legends mention that catfish behaves in an unusual way prior to an earthquake. Systematic scientific studies by Hatai and his group in 1932 showed that the catfish is sensitive to electric current of very small magnitude of the order of microamperes Catfish in most of the cases behaved unusually prior to an earthquake but when the catfish was kept in a tank insulated from the ground, no such response was obtained. Further it was found that a V-shaped change of the earth current record could be correlated to the catfish activity and earthquake occurrence. From the above studies it can be concluded that the catfish is sensitive to signals of electric origin which seems to occur prior to an earthquake. The study of this change in earth current might be of great help in earthquake prediction, than the study of unusual behaviour of catfish itself.

The unusual behaviour of some other fish other than catfish has also been observed even by scientists prior to an earthquake occurrence. In this connection a study made by Terada (1933) shows a definite relationship between fishcatch and earthquake occurrance.

The quantum of fish catch of horse macherel, Caranx, coincided very well with the periods in which the seismic activity was very high. He speculated that some kind of mechanical stimuli associated with earthequake or seismic shock are directly felt by these fish or that the shocks effect the density of plankton at depth or changes the chemical nature of coastal sea water due to which these fish behave unusually and they approach the fishing ground in an unusual manner effecting the quantum of catch. The understanding of the physical changes due to which fish are excited to behave unusually may be of some help in earthquake prediction.

Unusual behaviour amongst animals prior to a large earthquake has long been told. There are many reports of small animals running away, unusual barking of dogs, neighing of horses, braying of donkeys, fussing of monkeys restless movements of horses, pigs, recoon dogs etc. prior to a forthcoming earthquake

According to a Japanese saying an earthquake is expected when snakes, centripedes, frogs and the like come out of their usual habitants. Birds, insects and worms are also reported to behave unusually prior to occurrence of an earthquake. Hens and cocks become restless, pheasants make noise, swallows, macaws and the like seems to feel something, swarm of red dragonflies are observed etc. prior to an earthquake occurrence. It appears that these animals

are sensitive to a very small tremors prior to a large earthquake motion so that they make a fuss after the arrival of primary waves.

There are many sayings and writings that weather turns sultry sometimes with mysterious mist and fog in the sky, rainbow of short length is observed, that a rainbow consisting of three colours—black yellow and indigo appears, that mysterious lights appear in the sky etc., preceeding an earthquake. However, most seismologist at present think that there may not be a relation between these phenomenon and an earthquake occurrence and these might be a fiction as well or just a mear coincidence.

The Japanese legends mention that decrease in formation and well water, sudden lowering or rising of the head of subterranean water and well water suddenly becoming muddy are precursors of an approaching earthquake. Scientific theories at present are able to account a forthcoming earthquake in relation to these changes in groundwater.

Changes in attracting power of a magnet prior to an earthquake are mentioned in legends, however the present day knowledge shows a very small change in this which can be detected and measured only by present day sophisticated instruments.

Statistical study has been conducted for earthquake occurrence in relation to the moon phase, position of the sun and stars etc. The studies suggest that earthquake occurrance are usually larger for the new moon, the full moon and for young moon. Further the earthquake can be triggered by mechanical forces arising from particular combination of celestial body position. However this appers to be a kind of astrology

So far earthquake prediction based on myths and legends were mentioned. Now in the following text earthquake prediction method based on scientific reasons will be described in four different stages with reference to 15 precursors mentioned below in details.

1. Land Deformation :—

Precursory land uplifts and other land deformations are reported resulting in sea retreat etc. Data for this precursor is collected by repeating levelling survey periodically.

2. Tilt and Strain ;—

Tilt and strain changes in earth's crust are measured with the help of bubble level horizontal pendulum tiltmeter, water tube tiltmeter, borehole tiltmeter and strain meter. Prior to an earthquake anomalous changes in tilt and strain have been reported in many cases. The time for getting this type of precursor is either in hours or in days, months and even in years.

3. Foreshocks :—

Occurrance of fore shocks or small shocks prior to main shock are reported since historical times. A seismically active region generally have number of small shocks varying in time called "background" tremors. The physical nature of these shocks is still not clear but generally it is seen that there are periods of calm before the main shock followed by small after shocks. However, it is difficult to distinguish between fore shocks and ordinary small shocks. The background tremor activity

oes through a minimum and increases just efore the main shock. The precursor me for foreshocks is the time interval etween the first noticed shock and the nain shock. The precursor time ranges on few minutes to a few hundread of ays for foreshocks.

. **b-Value :—**

Change in the value of constant b in he Gutenberg-Richter formula are reported. The b-value of foreshocks tends to decrease preceeding an earthquake. This is believed to be associated with stress-state around the focal region. The decrease has been interpreted in terms of dilatancy model discussed below.

5. Microseismicity :—

Sometimes decrease in number of microearthquakes has been reported prior to an earthquake. This also has been interpreted in terms of delatancy model.

6. Source Mechanism (Focal Mechanism) **:—**

Premonitory affects are provided by rotation of the compressional axes as obtained from fault-plane solution of small shocks, The compressional axes tend to reorientate in a particular direction prior to an earthquake which is supposed to be due to somekind of stress concentration possibly accompanied by production of very strong dilatancy in the neighbourhood of the incipient fracture. The effects are discussed under the heading dilatancy.

7. Fault Creep Anomaly :—

Few reports on change in the creep rate of fault, fold etc. giving precursory signals are available.

8 Seismic velocity ratio beetween compressional wave velocity to shear wave velocity (Vp/Vs)—

This ratio in an area of earthquake, considerably drops and recovers prior to an earthquake in many cases. The length of the period during which this ratio remains anomalous seems to be closely related with magnitude of the coming earthquake.

9. Compressional wave velocity (Vp) and the shear wave velocity (Vs) :—

Changes in Vp and shear velocity anisotropy also give rise to precursory signals Cases of 18 & 20% decrease in Vp values 300 & 110 days prior to earthquake have been reported respectively. Under nonhydrostatic stresses rocks indicate a velocity anisotropy & shear waves (S) are split up in two waves, one SV-wave in which particle motion is vertical and other SH-wave in which particle motion is horizontal. The velocity difference in these waves i.e. V_{SH}-V_{SV} increased by 2.3 & 2.5 % in two particular cases 3 & 10 days prior to two events of magnitude 4.0 and 3.9 respectively. This is thought to be due to anisotropic properties of dilatancy.

10. Geomagnetic Change

Seismomagnetic effect i.e. changes in the geomagnetic field associated with an earthquake, seldom exceeds 10 gammas. Similarly changes in geomagnetic fieid more than 20 gammas preceeding an earthquake has not been reported presently. The data of earlier years which reported a large change appears to be spurious because of inadequate measuring and noise elimination techniques.

11. Earth Currents

The earth current data do not seem, to match with data of different disciplines and inspite of several reports of anomalous changes in earth currents or telluric currents associated with an earthquake, no definite character of precursory signal has been brought to light so far. The fluctuations in telluric currrnts are primarily caused by temporal geomagnetic variations of external origin and it is difficult to corelate the fluctuations with earthquake occurrence.

12. Resistivity

Remarkable changes in electrical resistivity of earth's crust in some cases in U.S.S.R., Japan, U.S.A. and China have been reported. Resistivity decreases of up to 10-15% have been reported. To measure electrical resistivity, electrical pulses are sent into the ground and electric fields excited by these pulses are measured.

Resistivity precursors of short term and long term are used. The precursor time is also indicative of magnitude of earthquake. This could be explained by the help of the dilatancy model. In laboratory experiments decrease of 50% in electrical resisivity have been reported just before rock rupture.

13. Radon Emission

Changes in radon emissiom of underground water have been reported which can be explained by dilatancy model. Radon is a redioactive gas having a half life of 3.5 days. After the main shock radon content decreases rapidly.

14. Underground Water

The interpretation of change in the underground water is also effected by the weather and irrigation, however only few reliable reports are available on change in level and/or temperature of underground water. Change in flow rate of springs are also reported on the occasion of large earthquake. The springs always recover within several months time. No such reports have been received in case of hot springs.

15. Oil Flow :

Arieh and Merzer (1974) reported anomalous changes in amount of oil flow petroleum wells in the gulf of suez preceedinng an earthquake. It is thought presently that these changes are due to pre-earthquake deformations of the earth's crust.

Now before describing the four different stages of earthquake dilatancy will be explained, a mention of which has been made above.

Dilatancy

Earth's outer surface, i.e. crust, when subjected to a tectonic stress, is squeezed, deformed and eventually breaks up. Before breaking up rock swells due to opening and extensions of tiny cracks The phenomenon of inelastic increase in volume is known as dilatancy and begins when the stress reaches about half of the breaking strength of the rock.

The land uplift, decrease in the electrical resistivity, increase in radon emission, change in ratio of compressional seismic wave velocity to that of torsional wave velocity (Vp/Vs) etc. could be explained by models based on dilatancy theory.

The earthquake predictions can be made on the basis of effects of dilatancy, mentioned

bove, in the earth's crust.

Two principal models first called Wet-Model based on dilatancy generated in rocks saturated by water and second called Dry-Model based on dilatancy model without water diffusion have been proposed. The first one proposed by Amos M. Nur in 1972 and extended by H. Scholtz, L. R. Sykes and V. P. Aggrwal in 1973, while the second one claimed by Mogi, Stuart & Brady (1974) is also capable of accounting for the various precursory affects just as wet dilatancy model. Both the models have the common feature: the growth of microcracks probably oriented paralled to the axis of the maximal compresssion, as stress builds up in the crust, just before an earthquake.

In both models the stage I is marked with the building of elastic strain in the earth's crust. In stage II microcracsks are produced in the strained portion of the crust and dilatancy becomes a dominant factor. These open microcracks change the physical properties of the rocks and marks the real begining of the precursory signals. The ratio (Vp/Vs) of compressional wave velocity to shear wave velocity drops. In the Wet model electrical resistivity decreases, water flow though the rock increases and therefore more radon enters the water from the rock. The inflow of water to the newly created pores from existing pores result in a decraese in pore pressure preventing further generation of microcracks. The number of small tremors decreases at this stage resulting increase of sliding friction and inhibting faulting. As influx of water keeps up and overcomes crack generation, Vp/Vs ratio tends to increase. The pore pressure increases in the cracks, rock weakens and an increase in number of small earthquakes is obtained followed by the main shock.

In the dry model stages I & II remains same but in stage III water plays no role. The avalanche—like growth of cracks lead to instability and rapid deformations in the vicinity of main fault. A decrease in stress load occur in the region surrounding the zone of unstable deformation resulting in partial closure of cracks and recovery of original characteristics of rock. This sequence of events account for decrease in electrical resistivity & volume due to crack closure increases Vp/Vs ratio and causes other changes. The developing instability finally gives way to faulting and eventually to main shocks. The crustal rock recovers most of its original properties after releasing the stress by earthquake in both the models.

Earthquake Prediction—Four Stages

The science of earthquake prediction is still in an unripe stage. However the data acquired so far is of immence use in predicting an earthquake and in advanced studies in this direction. The prediction mainly based on time factor can be classified in four stages as below.

Stage I-Statistical Prediction

Statistical prediction of an earthquake can be made in an area by studying the previous earthquakes of the area. The studies made so far in this direction have revealed many periodicities in certain regions. An estimate of occurrence time for an earthquake having a specified magnitude can be given statistically. Though such studies are quite useless for predicting the occurrance of the particular earthquake but are

useful for quantifying earthquake risk in the area studied.

Stage II-Strain Accumulation Stage

The theory is based on the assumption that the earthquakes are caused by the release of the stresses along boundries of plates forming the continents. The theory is based on plate tectonics. According to this theory the earth's outer shell i.e. lithosphere is made up of perhaps a dozen rigid plates that moves with respect to one another. The plate movement causes compresion or shearing of earth's crust which finally ruptures causing an earthquakk. The accumulation of these strains can be measured and applying the probability theory the ultimate limit of accumulation of such stress can be determined from the time of the last large earthquake occurrance. The value of ultimate strains after which rupture follow can be used for predicting an earthquake. The prediction time here may cover a period of several decades, hence it may be termed as long term prediction.

Stage III-Stage Immediately Prior to Main Rupture-Prediction of Extremely short Range

There are many instances of sudden change in ground tilt, anomalous sea retreats, change in electric resistivity and the like precursors which occur immediately preceeding an earthquake of large magnitude These precursors can be used for predicting extremely short term earthquake and saving the human lives if not the property. Here precursor time do not seems to have any relation with the magnitude of the earthquake.

In the light of the above mentioned precursory signals and different stages of the earthquake prediction an account of the successful prediction of an earthquake of Liaoning, China will be described in brief

Known Instance of a Major Quake Predicted by China-Liaoning Quake

A major earthquake of magnitude 7.3 occured at Liaoning, China on 4th Feb. '75. The earthquake was successfully predicted many years ahead and preventive mensures saved heavy losses of property and livns.

Seismologists by 1974 predicted likely occurrence of a strong earthquake within two years on the basis of anomalous insrease in seismicity and crustal deformation. During Nov. 74 the rate of crustal deformation and the tilt along one of the principal fault in the area was found increasing anomalously. Begining from Dec. 74 and a continued increase quring Jan. 75 an unusual behaviour of animals, bubbling and level changes in water wells, increase in radon content of water was reported by agricultural communes. Diaster preparations in turn were intensified.

A series of small earthquakes characteristic of foreshocks began to occur around the begining of Feb. 75. Other precursory signals such as a change in dierction of tilt of the surface, level changes in water wells coming up in artesian state and unusual behavior of animals—cows, horses, dogs, pigs and even of snakes was reported. Based on these precursory signals an evacuation order was given. After a few hours of final evacuation order the quake occurred. Prediction helped to avoid heavy losses of property and life.

There are no doubts about the benifits of prediction of an earthquake but the side effect, long term as well as short term, are yet doubted.

)TES & NEWS

terproofing Treatment for Exposed Masonry Lime Concrete Surfaces.

Masonry structures of brick work, stone-:k, concrete blocks and prefabricated :k panels etc. are sometime left unplaster- These exposed structures usually fail :esist rain penetration and require a water-›ofing treatment to check water seepage. vaterproofing system based on indigenous v materials has been developed by the ntral Building Research Institute, orkee. The treatment is economic ; easy apply and durable and has been success-ly tried out on various exposed masonry d lime concrete surfaces. The water-›ofing treatment developed is a two-com-nent system consisting of an under-coat d a finishing coat. The ideal season for : application of the waterproofing treat-:nt is before the on-set of monsoon when e exposed masonry walls and lime concrete ofs are quiie dry. It is estimated that the st of material for treatment of one square etre of brick masonry and lime concrete rface would amount to Re. 0.96 only.

The process does not need any special cilities and is well suited for small scale dustry. The total capital investment for production capacity of 400 litre per day is timated Rs. 1.60 lakhs.

For further details, reference may be ade to the Director, Central Building esearch Institute, Rookee (U.P.)

wards for Articles Published in Fai Journals.

With a view to encouraging authors to ontribute a larger number of quality articles for its various publications, the Fertiliser Association of India had instituted in 1971 annual awards to be given to authors of out-standing articles published in its journals. It is generally agreed that these awards have been instrumental in increasing the flow of contributions and upgrading their quality. These awards have, therefore, helped in achieving the objectives for which these were established. In recognition of this fact and to provide a further stimulus, some member firms of FAI have kindly offered to establish a new series of awards to substitute the old ones. The quantum of awards for the first and second prizes has been substantially increased. Besides, a third prize has been introduced for each series as recommended by the various Selection Committees over the last couple of years. Details of the awards are as follows :

1. Shriram Awards

Shriram Chemical Industries, New Delhi for the articles on Marketing including logistics, distribution, market research, and economics published in 'Fertiliser News' and Fertsliser Marketing News' and for Hindi articles published in 'Khad Patrika'.

(a) **Marketing**

First Prize—Rs. 1500

Second Prize—Rs. 1000

Third Prize—Rs. 500

(b) **Khad Patikar**

First Prize—Rs. 1500

Second Prize—Rs. 1000

Third Prize—Rs. 500

2. FCI Awards

The Fertiliser Corporation of India Ltd., New Delhi, for the articles on Production & Technology.

Production & Technology

First Prize—Rs. 1500

Second Prize—Rs 1000

Third Prize—Rs 500

3. **Dhiru Morarji Memorial Awards**

Dharamsi Morarji Chemical Co. Ltd., Bombay, for the articles on Agricult Sciences :

Agricultural Sciences

First Prize—Rs. 1500
Second Prize—Rs. 1000
Third Prize—Rs. 500

These awards became operative in 19 (for the period. October 1976 to to Septe ber 1977). It is our earnest belief that munificence of the donors of the new awa will attract a larger number of contributic for our publications for our publications a further improve the quality of writing these journals

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- It now offers membership to respectively qualified persons in seven categories: Fellowship (F.I.S.E.), Membership (M I.S.E.), Associate Membership (A.M.I.S.E.), Licentiateship (L.I.S.E.), Associateship (Assoc. I.S.E.), Graduateship (Grad. I.S.E.), and Studentship (Stud. I.S.E.).
- It has on rolls nearly 5000 members within the country and all over the Globe including Bangla Desh, Burma, Ceylon, Singapore. Malayasia, Middle East and African countries the U.K., U.S.A. and West Germany.
- It publishes a Monthly Journal, "SCIENCE & ENGINEERING", from 1935, commanding a circulation throughout the world.
- It maintains a Library containing above 2,000 volumes of Books and Reports.
- It has published some technical text books by noted Member-Authors. e.g. "Building Materials", & "Mineralogy, Petrology & Economic Geology" : Tables (an enlarged Third Edition of this latter work i. e. the TABLES has been recently published by the Indian School of Mines & Applied Geology, Dhanbad.)
- It conducted Postal Coaching for sometime, also a Refresher Course for Electrical Supervisor's Certificate examinees.
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- It acts as a principal sponsor of the Federation of Professional Engineering Institutions of India (F.P.E.I.I.) cum the Joint Indian Engineering Council (J.I.E.C.).
- It of late has set up a BRAIN TRUST along with Technical Information Department to provide aid and guide to Operational Research and Practice in different fields of Engineering and Technology.
- It has on its record the association of eminent personalities like Bharat Ratna V. V. Giri, Late Sir C. V. Raman, Dr. Kailash Nath Katju, Dr. J. C. Ghosh, Nawab Zain Yar Zung Bahadur, Prof. Bhim Chandra Chatterjee, Dr. B. N. Dey, Air Vice-Marshal Harjinder Singh, Dr. J. N. Basu and Engineer - Administrators like Dr. K. L. Rao, Dr. T. Sen, Sri T. R. Gupta, Sri P. C. Bose, Sri P. C. Mitra, Sri S. S. Mukherjee, Dr. K. R. Chakravorty, Sri U. P. Mullick, Sri .N. Chowdhuri, Sri H. D. Bhowmick, Sri N. N. Chakrabarti, Dr. H. N. Sethna, Dr. R. Ramanna, Sri S. Samaddar and of leading industrialists like Late Shri R. L. Kirloskar of Yantrapur, Mysore, and Shri G.D. Naidu of Coimbatore.

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SCIENCE & ENGINEERING

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A Tale of Two Cities

Calcutta is fast reaching the 10 millions mark in population, when New-York is stagnating somewhere near 11 millions. And yet 'Start the Fourth Jet Port' headlined sometime back one New York newspaper editorial, concluding with usual warning that unless the project begins 'immediately' it might be too late. It was too late in the sense that it was inexcusably late, that New York had been compelled to surrender some of its leadership in commerce unnecessarily. But in any event, simply satisfying the chronic needs for another major airport was never a complete solution for the transportation ills that afflicted that great city.

Calcutta is satisfied with its one airport, at DumDum. Here we are more concerned with what the VIPs (important persons) think, and to what they are expected not to look at. We have spent quite a good amount of money in laying a VIP road from Calcutta airport to the city, as an alternate for VIP use to the old dusty Jessore Road link. We have spent tons of money beautifying that VIP road instead of beautifying main city avenues, in laying boulevards in the city or in setting up cheaper hub terminal of city conveyance near the airport for cheap use by the common air passengers.

In New York they are seeking, amongst other goals a 'transformation in transporation' that goes far beyond a new jet airport or more express ways. The new airport there when it comes 'may not even be identified with New York'. There has been support for Calverton, location at eastern end of Long Island as an exploitation of an existing resource. The virtues of Bearfort Mountain and Bowling Green Mountain sites have been extolled. Case for Solberg in Hunterdon county, New Jersey, has been examined as the last possible 'close in' site readily accessible to residents of the metropolitan area. What concern them is whether or not 'busyness' wlll mean business' for the New york city Metropolitan area or for some other locality.

In Caleutta we have yet to think of a second city air terminal for the middle class and business, or an extended air hop from Calcutta airport to the Maidan Green or cheap air taxies to it, or to an airtaxipad, or of a helipad in B.B.D. Bagh East (Dallousie

Square East), removing all the long length of dung heaps and filth, or in Tollygunj Maidan (on one side of Race Course or Golf club area).

The forecast for 1970 for New York showed that air passenger traffic would continue to grow rapidly over the next ten years and would more than triple by 1980. Airlines would be carrying 470 million passengers, three times the 1968 fiscal year total. The rate of rise forecast in air traffic was 17 to 270% rise annually based on Kennedy, Laguardia and New York. In Calcutta we have still to think of connecting air hops between Maidan Green Port and Santiniketan, or with Maldah, Durgapur, Asansol, Burdwan, Navadwip, Murshidabad or Purulia.

Stuart Tipton, President of the air transport Association stated that a continued lack of adequate airport and airways facilities would mean loss to New York city's economy at $ 205 millions a year by 1975. Has anybody calculated what Calcutta suffers commercially from a lack of second city airport, a 'Greenport'. ? We have removed the experienced veteran J. R. D. Tata from the Airlines and Air India chair.

It has been estimated that when economic conditions in New York are growing increasingly negative, there are signs that a mass economic exodus may also be in the making. Buying power in New York has long been leaving the city. It is being apprehended those who move out will not return to reside there and many will not come back to do business there. People who decided that New York city was not a good place to live, are now concluding that it is not a very desirable place to live either'. Further, New Yorkans faced the prospect that New York might surrender its status as the eastern terminus for United States air travel, and unless decongestants can be applied to relieve the saturation point at the city airport, New York will become the favourite bypass on the world's skyways. In Calcutta however we went one better. Let alone thinking on air taxi, or 'Maidan green airports', we manipulated our political and civil fronts in such a manner that most of the World's skyways by passed already the Calcutta city.

A New Yorkan says, 'Do I paint a gloomy picture ? I grew up here, have lived here, and I am depressed by what I see happening in the city and to the city ? Behind a facade of progress which the construction activity on the Manhattan implies, the city is being drained of its economic substance. In 1967 New york added 8 million square feet of office space, 30 millions more were to be added by end of 1968, but many of the city's most economically productive tenants were fleeing. In 1950 one million people were employed in manufacturing in New York city. By 1967 the figure was 16% below 1950. In fact the stock exchange there wanted to leave Wall street. The garment industry was expecting to take up residence elsewhere. Whole salers were moving out. Businesses were increasingly seeking location beyond the city limits.

Some of the largest American Companies, Pepsico, American Can Co. Clin Olin Matheson, Flintkote, Corn Products and others had moved, and reasons were high taxes and rents, inconvenience and discomfort of commutating, difficulties in getting satisfactory clerical help and problems with Unions.

In Calcutta, we are of course not as far as that. Here though the Stock Exchange in Lyons Range is not yet thinking of moving out of the apronshade at Writers' Buildings, from Lyons Range, and the mass of industrial magnates are still crowding the city centres, yet there are signs that office areas are getting decentralised, and manufactures are moving out of the city.

In New York while the manufacturing industry are pulling out of the city, what is gloomy there is that the city is losing its stature as the consumer capital of the nation. The reason is that while cities through out USA grew 3.2%, their suburbs grew 17.7%.

When we look back to Calcutta we find that in 1940-42 the city suburbs were growing equally fast up, and the well-to-do then were pulling out of the city. But the political instability changed the scene. The suburbs are now growing at a slower pace, and instead of the well-to-do, the poorer classes are swarming the suburbs. While the rich with their cars would have been better off in the suburbs, it is now the poor in the distant suburbs who are adding to the commutation problems of the city.

David Rock feller said that to .preserve the intergrity of the city structure, it was important to make sure that the core areas were healthy from an economic point of view. This means to make the central city areas more attractive for business. Are we doing the same for Calcutta ? Here, added to the commutation problem, we are daily making the business life of the city more difficult, what with congestion and obstructed roads and, garbage, with insufficiency of cheaper city office spaces and flat spaces, and with rapidly falling purchasing power.

Since 25 years ago, the tide of the then rich New York population began pulling out to suburbs. The debarkation was in form of a pyramid, the top income-bracket left first, then the exodus worked its way down, until the last of the middle class fled. The suburbs developers took advantage of the new buying power of those who took residence there. Business and Commerce moved with the shopping centres. Shopping centres accounted 41% of all retail sales.

In that respect the city of Calcutta fares much better. While the flight to suburbs in New York by more than a million tax payers, and their replacement by unskilled and largly unproductive elements severely affected the economy of New York, where more than 30 per cent of the applicants for clerical jobs were unable to complete

their application forms properly, in Calcutta the well-to-do and rich are airing themselves in the city's posh areas of Alipore, Ballygunge and New Alipore still, and on top of multistoryed structures in flats, while the Employment Exchange here does not guarantee a correctly worked application for job, and our budding applicants are no worse than New Yorkers. Again real estate in New York city is highest in the country. It takes $ 10,200 a year to maintain there a family of four. Our City Corporation is not behind. Its taxes are galloping high annually, but the receipts are all spent up in salary payments, leaving nothing for city development.

Yet what one encounters in New York today is principally a crisis of transportation, and yet transporation developments are not a part of the $ 50 billion Master plan for New York city. We do not know what is the cost of the Master plan for Calcutta probably 3 billion rupees (Rs. 300 crores) that is 0.4 billion dollars, and yet while New York is thinking of massive development projects including new housing and office construction, incentives for building under ground pedestrian walkways, or new hospitals and apartments, we are not thinking of underground pedestrian walkways alongside of our tuberails for short stage walks, as we have already let out our surface footpaths to vendors and stall holders and squatters, and we break up chronically the footpaths sufficiently to be permanently put out of use.

Traffic moves at an average pace of 7 miles per hour in New York city today. With old time horse drawn carts it was 11 miles an hour. Our horse drawn tram cars were over since 1904. We have now given license to minibuses carrying middle-low middle classes to ride over the heads and bodies of the middle class Scooterers at a speed over 40 to 50 miles an hour in the Calcutta city's conjested streets. There we have recorded some points in our favour, whereas in Master plan investments we have lost. On another point we are even. The people in New York today buy less and pilfer more. The city has at last a night life from a white collar to blue collar, and now to a largely no collar society. So has Calcutta. But that is not the end of it. New York electric lights offer at least a night life. We have been able to plunge our city in peaceful no-work darkness, but our candle sales have increased again beating New York.

SILICONE FLUID FOR TRANSFORMER

By

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Silicone fluid-an inexpensive nonflammable, low toxic liquid for a substitute for conventional transformer oils.

Hundreds of power transformer manufac-urers used a non-flammable dielectric liquid or transformer cooling over forty years, which is generally known as "Askarel". The chemical name of "Askarel" is "Poly-hlorinated-Biphenyls" with five chlorine toms per molecule. As a result of an nvironmental test, it was concluded that its ise in an industrial environment for a long ime may cause cancer-producing viruses ind some adverse effects. To avoid these iazards, silicone dielectric fluid should be ised.

Silicone dielectric fluid is a nonflammable within certain range), low toxic, non-propa-gating liquid which has satisfactory physical properties, adequate dielectric strength and s very compatible with insulation systems and practically an alternate or substitute for "Askarel". It is a colorless liquid having ow surface tension, chemical and oxidation resistance and a small viscosity change with temparature. Its chemical name is, "Dime-thyl-Sillcone Fluid" and the chemical struc-ture is as shown in Figure No. 1

* This paper was received on May 1978.

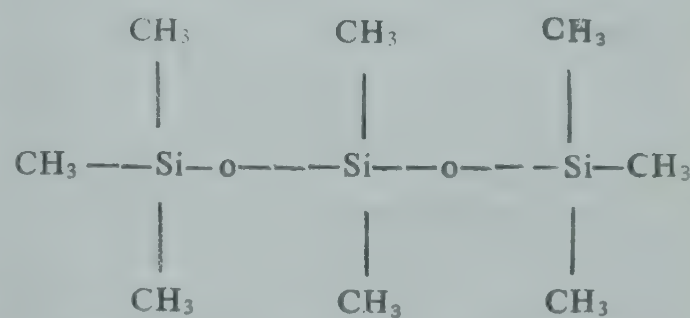

Figure No. 1 : Chemical Structure of Dimethyl-Silicone Fluid

Over a long period of time, Dimethyl-Silicone Fluid has been used in fascial cosmetic applications and in applications involving direct contact with foods without any known hazards and certain adverse effects on the environment.

Heat transfer characteristics of silicone fluid above twentyfive degrees centigrade may cause viscosity difference. This difference pre-sents a serious problem for refilling an exis-ting Askarel-filled transformer with silicone fluid. Design of transformer cooling equip-ment of existing or new transformer must allow standard temperature rises of silicone fluid over normal ambients. Silicone fluid

has a higher coefficient of thermal expansion which means there is a greater rise and fall of the liquid over its expected temperature ranges. Greater solubility of air or nitrogen will minimize pressure increase at high temperature. Silicone fluid has less lubricity than other transformer oil or Askarel, which may cause a problem for oil type tap changing mechanism of an existing transformer. Properties of silicone fluid are shown on Table No. 1.

TABLE No. 1

	Askarel	Mineral Oil	Silicone
Viscocity at 25°C.	12.8 CS	10.0 CS	50 CS
at 85° C.	4.2 CS	2.7 CS	20 CS
Fire point	None to boiling point	150° C	316° C
Coefficient of expansion— Cubic cent./centigrade	0.0007 cc	0.0007 cc	0.00106 cc
Pour point	—55° C.	—55° C.	—40° C.
Dielectric Constant 25° C.	5.3	2 2	2 7

Although silicone fluid can be used practically with all insulation materials silicone rubber gasket in Askarel or oil transformer will disintegrate rather rapidly Besides all of these little disadvantage fluid transformers will be more economical in several countries where the price of silicone is less than dielectric mineral oil or Askarel. Silicon-filled transformers will have the same life expectancy as an oil or Askarel transformer.

SCIENCE NEWS SERVICE IN INDIA

By

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Abstract

Popularisation of science and the development of a scientific temper are of great significance in an age of science and technology. This particularly so for a developing country like ours, inhabited by people of different races, religions, castes and traditions.

The mass media do play a vital role in providing today's citizens with uptodate information on the achievement of science. In India however due to inadequate and unsatisfactory coverage by mass media and low level of literacy and education, the awareness about science and its development remains dormant.

*Paper presented at the Seminar on Science News Service, 11-12 March, 1978, Indian Science News Association, Calcutta.

**The views expressed in this paper are of the author himself only and does not reflect in any way the policy of the organisation to which he belongs.

The mass media has been popularising science only as event oriented. It has been due to the lack of science writets/communicators, appropriate material for publication etc. It would point towards the strong felt need for organising short-term training courses for science writers as well as the establishment of a full-fledged science news service in India which may collect, interpret and process science news with the spirit of of the general news service as being used by newspaper, radio and television. The paper describes in detail, while underlying the importance of science popularisation, a functional model on the formation of the Science News Service in India.

Science and technology have become the social dynamic of our time. It has been influencing recently the lives of people in a variety of ways. Science is fighting hunger, malnutrition, diseases, pollution, etc. giving new dimensions to the set-up of the people. It is an inescapable fact of our times that science and technology are changing our world—changing it beyond anything we may imagine or desire.

Popularisation of science and development of scientific temper are of great significance in an age of science and technology. It is particularly so for a developing country like ours inhabited by people of different races, religions, castes and traditions. There is a growing need only for disseminating the scientific and technical information influencing our material welfare but also for combating obscurantism and superstitions and for creating a climate for science to enable the people to develop a rational approach to personal and social problems.

The history of modern science in India shows that science did not develop as a widespread intellectual or social movement as in the West, changing the very character of Indian society. There was an isolation of modern science from society in India. Science was studied in a foreign language by an erudite minoritiy for its intellectual stimulation. The large masses outside the formal system were practically shut out. This situation still obtains in this country. Science belongs with those disciplines that traditionally have been regarded as essential to man's cultural environment. Yet the common man fails to see it in this light. The uninformed public think of science and technology in terms of a specific set of devices and practices—the automobiles, machines, electrical gadgets, TV sets etc. Students, especially in rural settings, tend to equate scientific revolution with urbanization and have developed a notion that scientific progress is possible only in an urban society.

Though people are fascinated by the achievements of science and technology it cannot be denied that most of them consider that science can be understood only through a bard and painful intellectual process. The gap between scientific achievements and its public awareness is increasing everyday. Greater public awareness about the significance of scientific development gives a nes hope to the citizens and inculcates scientific temper among them. Scientific communities and national governments are becoming more and more cognisant of the pervasive role which S & T information plays in social and economic development of a nation. For example

rural development is possible only when, rural folk is educated about appreciating scientifically the usefulness of farm equipment, fertilizers, hygiene and sanitation, fruits preservation, dairy products, etc. A ground is to be prepared for the acceptance of new ideas (scientific ones) by the rural people.

Event Oriented

Though some efforts have been made in this direction, yet the greatest weakness of the present efforts towards the popularisation of science is their being over-whelmingly 'event-oriented' such as moon landing, nuclear explosion, heart transplant, green revolution, satellite transmission, etc. But the real problem lies in disseminating concepts and motivating people to have scientific outlook in their lives for better living.

Science journalism is very much in its infancy in India. There are historical reasons for this. Mostly the developing countries were under the colonial rule some 30-40 years ago. The rulers did not encourage science and tecnology. After the attainment of freedom, socio-economic problems came to the forefront. The press naturally devoted more space for reporting these events. We eventually realised the importance of science and technology to the economic development. The attainment Indian independence and the oft-quoted need felt by Pandit Jawaharlal Nehru for creating a prorer atmosphere gave a great fillip to the move of science popularisation in India. The concerted efforts to increase the educational facilities at all levels, the establishment of a large number of R&D organisations, the spelling out of science policy resolution, etc. have contributed to this urge.

Education for development is one of the reponsibilities of the mass media communication. The more effective the communication the faster is the growth. While India is making tremendous progress in the use of the printed world, there is still a vast majority of the people who are illiterate. The lack of education thus limits the scope of the use and purposeful manipulation of mass media message. The progress of our country depends on a large scale scientific orientation of the literate masses through the media of books, newspapers, periodicals, etc. and the illiterate ones through the audio-visual methods.

The UNSECO has suggested that the minimum standard of mass media growth for developing countries might be to provide for every 100 of every inhabitants ten copies of newspapers, five radio receivers, two cinema sets and two TV receivers. But this standard is too difficult to reach the many developing countries.

The meaning of technological achievements made during the last three decades would not be appreciated unless people have an intelligent understanding of new developments and their effect on their life and environment. The mass media play a vital role in providing today's citizens with uptodate information on the achievement of science. In India, however, due to inadequate and unsatisfactory coverage by mass media and low level of literacy and education, the awareness about science remains dormant. The average person is

ll untouched in terms of the attitudnal anges which the progress of science and chnology should have made. Mass media ive not been successful in encouraging ientific temper which is necessary to foster evelopment and social change and put mocratic functioning of the country on e even keel (Figs. 1 & 2)

Transfer of information is an inseparable irt of research and development. All those oncerned with R&D must accept the responsibility for the tranfer of information in the same degree and spirit that they accept responsibility for R&D itself. The dissemination of scientific and technical knowledge is as important as is its generation. To quote Bertrand Russel, from his book what is science (edited by J. R. Newman)—

> "Whether men will be able to survive the changes of environment that their own skill has brought about is an open question. If the answer is

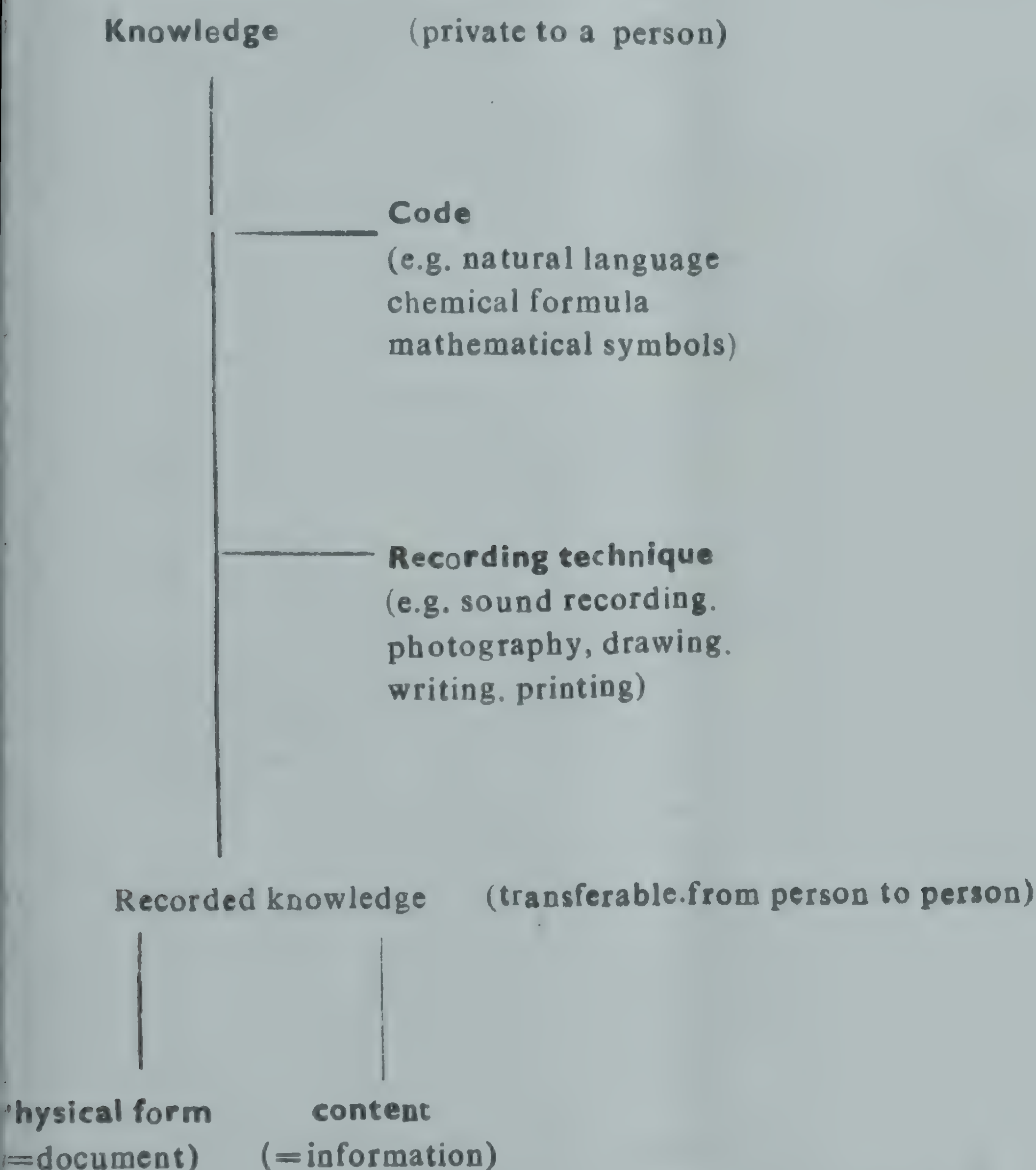

Figure 1. From knowledge to information

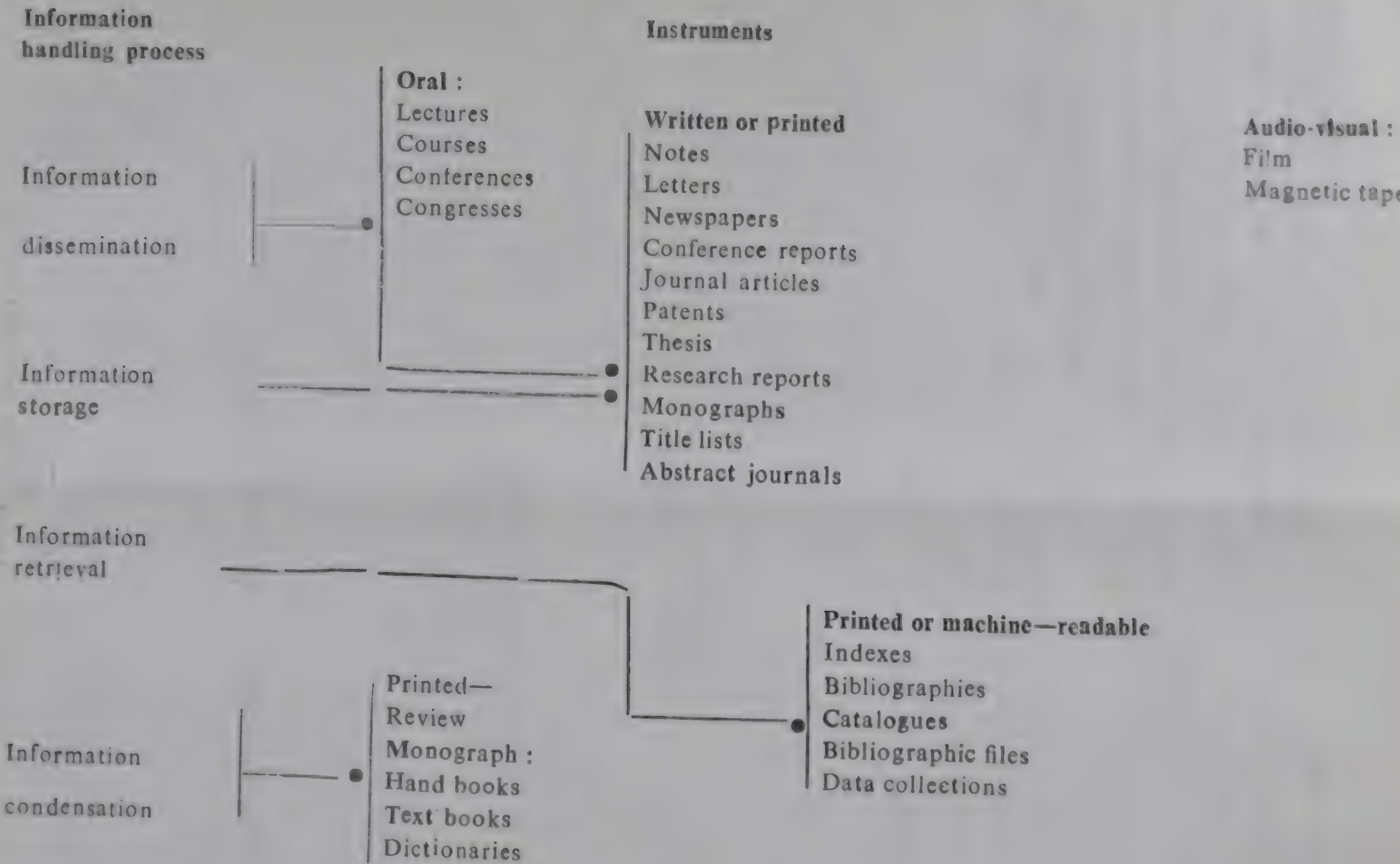

Figure 2 : The four major processes of information handling [illegible]

in the affirmative, it will be known some day ; if not, not. If the answer is to be affirmative, men will have to apply scientific ways of thinking to themselves and their institutions. They cannot continue to hope, as well as politicians hitherto have that in a world where everything has changed, the political and social habits of the 18th century can remain inviolate. Not only will men of science have to grapple with the

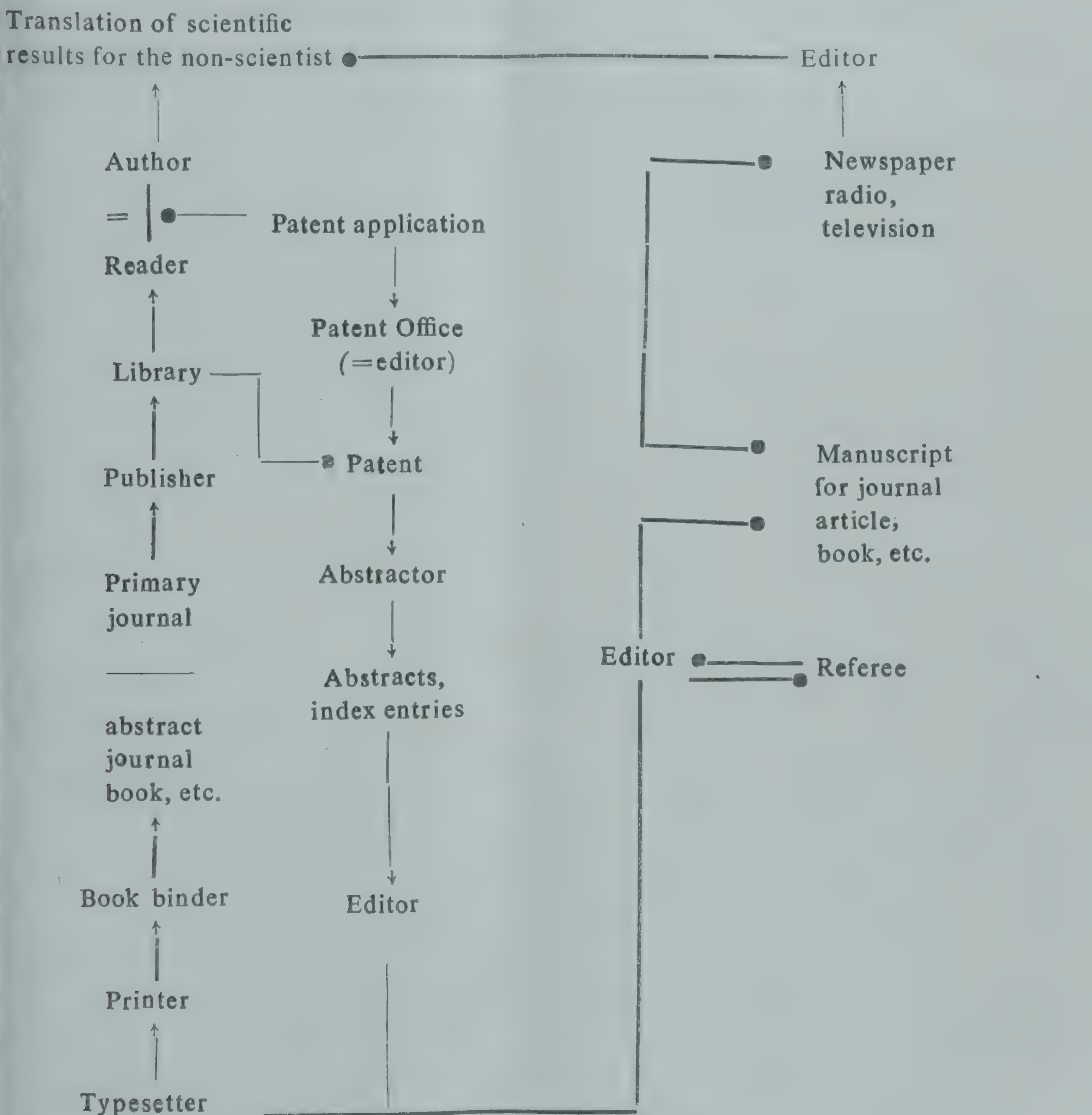

Figure 3. Information flow diagram

sciences that deal with men but this is a far more difficult matter-they will have to persuade the world to listen to what they have discovered. If they cannot succeed in this difficult enterprise, man will destroy himself by his half-way cleverness".

Let us now turn to the other side of the coin. The scientists and technologists of of our country, as in any other country, live in two worlds-their own society and country and the international community of scientists and the community has been generally very feeble in our country. In the new dimensions of science and technology and its application to the benefit of our society, this coupling between our society and our scientists need to be much closer. This will help our scientists, not only to perceive the relevance of problems, but to identify them with clarity and precision and take steps towards their solution and to the generation of new problems. It is in the methodology of finding solutions to these problems that our scientists will find the association of the international community of scientists valuable.

Manpower Development

Not all the scientists can be expected to devote themselves to popularisation of science. Some may not be good at it and even among them, there may be some who are too busy with their scientific work to devote attention to science popularisation. But such an active scientists should help his colleagues or professional science writers who try to explain his work, instead of regarding popular lectures given by his colleagues as an attempt to earn popularity or as cheapening of science.

A major problem of science popularisa-

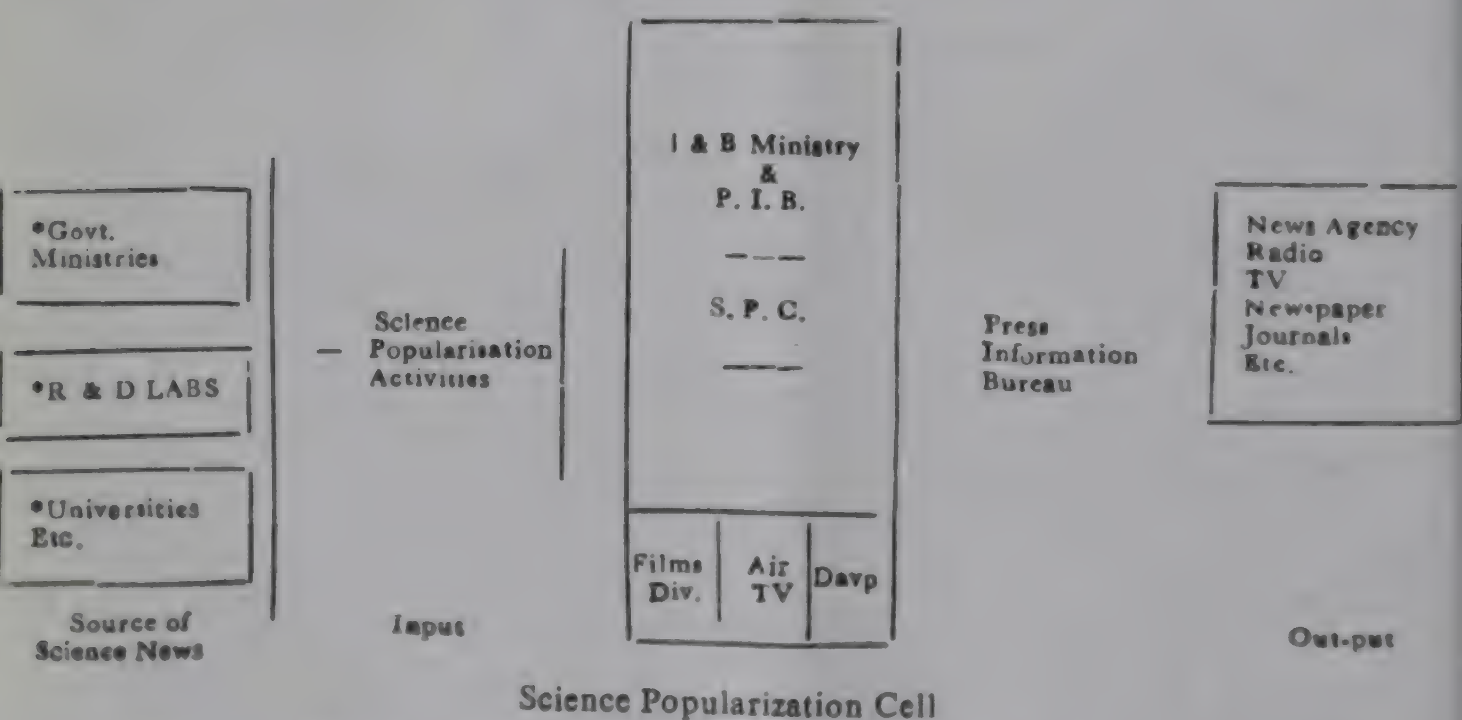

Fig. 4 : Formation of a Science Popularization Cell In P.I.B. (I & B Ministry)

.on in India today is that if we try to make popular, it ceases to be science and if we make it science it ceases to be popular. In other words people who understand science cannot explain it (scientists) and the people who can explain it (reporters) cannot understand it. So a bottleneck which has hampered the development of science popularisation in India is the lack of training facilities, in the field. The exploitation of scientific knowledge and the consequent effects of modernisation, industrialisation and urbanisation have added new fields and dimensions to science writing. Efforts should be made to train scientists in the art of reporting and journalists to understand the basic principles under lying scientific projects; in India little attempt is being to teach the techniques of communicating with non-specialised audience.

University tutors feel that it is not their responsibility. The result has been the production of scientists with a commendable sense of obligation to their specialised area of scholarship but with little to society. In USA, Holland, USSR, etc. short and long term courses are held for the purpose on technical communication.

The Indian Science News Association, Calcutta, the Indian Institute of mass Communication, New Delhi and similar other professional bodies should organise short-term training courses seminars on science writing, reporting and editing for persons engaged in the profession, in collaboration with R&D organisations of the country. This will be go a long way in creating a bread of science writers very spreading the message of science in eordt nook and corner of the country, resulting in the growth of scientific temper in its itizens, raising the standard of people anf overall development of the nation.

The progress and prosperity of a nation depend largely on the effective utilisaltion of its human and material resources through industrialisation while the import of advancced technical know-how could provide the the means of development and exploitation of skilled personnel could not be done either in large number or for an indefinie for educating the country's industrial manpower in science and imparting technical skills. Current advances in scientific and technical developments have increased the demand for technical writers and for personnel with related qualifications.

Science News Service

The need as well as the opportunities for popularisation of science are far greater now than ever before. There is far more science to communicate and the intelligent audience is also many times greater in number now, than at the end of the last century. There is also a much wider range of communication channels now but finds the use of these channels pathetically inadequate.

Regarding the space provided for science in the mass media, that far less space is given to science than to a discussion of economic affairs, or which horse will win the Derby. Many newspapers give regular space to astrology but not to science, a change in this trend is desired.

Editors of Newspaper and producers of radio and T. V. programmes are giving occasional coverage to science, may be event oriented, every fortnightly or monthly. But with a view to inculcate scientific temper

among people, they should do it more regularly. Here, it is felt that in an effort to do so they are handicapped by the lack of material for publication. Big newspaper may employ science writer for the job but not the smaller ones. A practical solution of this problem is that the Press Information Bureau (Ministry of Information and Broadcasting) should from a separate "Science popularisation Cell" to make such literature available throughout the length and breadth of the country in all languages through *Science news Service* and to coordinate dissemination of science information for the mass media, enabling the mass utilisation of newer technologies. This would not only serve the purpose of dissemination of knowledge but also create awareness of scientific achievements, progress and their impact with the society and particularly its role in the transfer of technology to develop rural and urban areas may be significant. Thus with the utilisation of all channels of of mass media viz., newspaper, journals, radio & T. V., there is every chance of common man keeping himself well-informed of the progress in science and technology.

Now the problem before the seminar is to come out with a fool proof system for the effectual dissemination of S&T information or the formation of a Science News Service in India. The idea was mooted by me in 1976 (see ref. No. 5) independently and cannot comment if it was thought earlier by anyone else in this big country Since the PIB existing news agencies (UNI, PTI, Samachar Bhariti, Samachar etc). could not do justice to the job of spreading the message of science even after 30 years of independence. we have now to plan a systemwithin the bigger existing system using there bythe available infrastructure.

Following the existing practice, in the case the political and economic news, which are generally received by the mass media from the PIB as well as from news agencies Science News Service should also be planned in the same way for its wider coverage by the mass media and the development of scientific temper among the citizens. Two separate flow- sheet charts have been drawn for the establishment of Science News Service (SNS) in India.

The SNS can be established at any organisations like Indian Science News Association, Calcutta where the infrastructure is already existing and one can launch upon the project immediately without any further loss of time (Fig. 5)

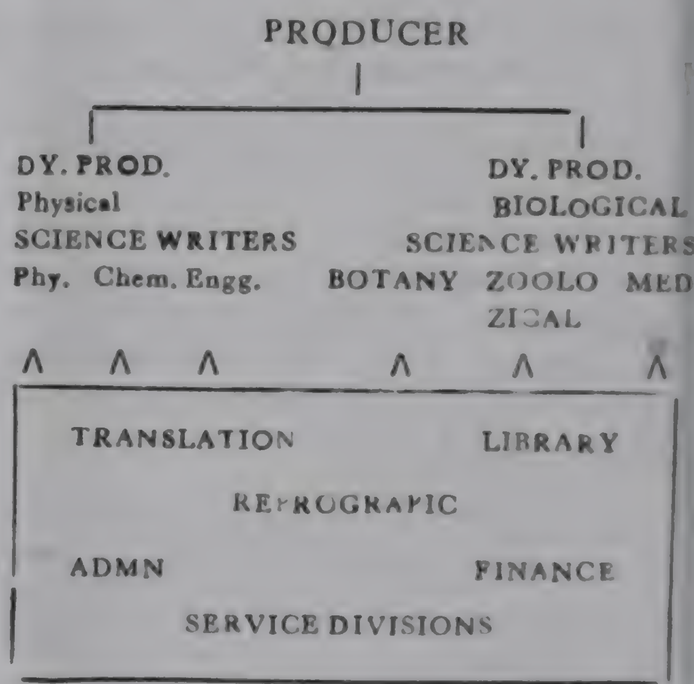

Fig. 5 A Flexible Model for Science News Service in India.

Conclusion :

"When we can show the majority of the people that the result of a scientific endeavour is far more important, more exciting and more interesting than the result of the

:rby or the mumbo-jumbo of astrologers, e popularisation of science will have made al progress. We have still a long way go". This was how the British Nobel ureate, Sir George Porter concluded his marks while receiving the Kalinga Prize r 1976, in New Delhi recently.

Quoting Sir Lawrence Bragg—whom he cceeded as Director of the Royal Institu-on Sri George felt it was the duty of ientists, in return for the support they were ven by the community, to render an count of their achievements in a manner adily understood by the laymen.

Science has become linked to nearly all pects of man's existence in various ways. :ienee and society are both dependent on ich other for survival. No longer can ience be taugnt as a subject valued for self independent of the rest of the society overned by its own rules and methods. or effectively blending education with ie culture of each society science ommunicator must understand the culture and enviroment

Science and its communication seems to e closely bound together so that the roduction and dissemination of the results of R&D go hand in hand. We should make every effort to absorb science into life, bringing to it an understanding collaboration with the human arts. All indications are there that future research will continue to increase in quantity and more important in complexity. Those who can blend the results of sophisticated scientific investign-gation with the communication techniques will have a key role.

REFERENCES

1. Pawan Sikka—Science Writing for the masses. The Hindustan Times—17 Sep. 1972.
2. Pawan Sikka—Technical Communication Indian & Eastern Engineer—Feb. 1973.
3. Pawan Sikka—Scientist and Information explosion Mainstream 26 April, 1975.
4. Pawan Sikka—Science & Tecenology and Economic Growth. Mainstream 10 April 1976.
5. Pawan Sikka—Communication for science. Science & Engineering Oct. 1976
6. Pawan Sikka—Social development through science. Paper read at the work shop on communication in '80s. Dec. 1977 New Delhi.

Clinical Engineering And Health Care-Some Aspects

By

T. G. KRISHNA MURTHY *

A planned approach will be beneficial for highly populated non-affluent developing nations of the world for effieient utilisation of the rather limited financial resources. One has to be realistic to ensure better patient care using recent techniques. In general, medical equipment is designed to provide safe and reliable performance. This implies higher longivity and lower rate of obsolecence. Medical institution are also not in a position to buy frequent, One has seen the transition from valves thro transistors to integrated circuits. The last decade has seen phenomenal advacements in technology. The extent of impact on health care varies from nation to nation depending on the nation's economic status. There has been an escalation in the cost of medical care. In many countries majority of patients are hospitalised almost at the terminal stage. For example, a surgical case involves patient cost in the form of presurgical hospitalisation, diagnostic investigations, actual surgery, post surgical recovery and medicines. One has to necessarily add the cost incurred by patient attendants etc. In non-affluent nations, non-invasive diagnostic and therapeutic techniques are invaluable.

In recent years, especially in the last decade, a number of useful techniques and devices have been developed and clinically utilised. They are safe, simple and economical for being utilised in out-patient services of urban or rural hospitals. Wider clinical utilisation depends on the medical profession of the concerned nation. Proper briefing of medical and paramedical staff about the utilisation and limitation aspects is the responsibility of those who develop and market. The medical profession is rather cautious and reluctant to change over to new methods from the traditional ones. Convincing the profession involves long term dedicated efforts.

A phased step by step method may be helpful in equipping urban and rural hospitals in the country depending on various factors like inpatient—outpatient workload. availabity of medical and paramedical personnel, recurring and non-recurring financial resources. A realistic apprisal leads one to c assify equipment as essential, useful, and optional for passed and progressive procurement. The essential includes day to day equipment used in diagnosis, therapy and bioanalpsis. Equipmet, like diagnostic X-rayunit, ECG, respirator colorimeter, incubator, microscope, centrifuge, infra red lamp, neuromuscular stimulator, ultrasonic therapy, surgical diathermy, etc., A major percentage of patients about 60 to 70 percent can get relief from their ailments by using the above

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amed equipment. An enlightened physiian surgeon aided by competent techninions n X-ray. ECG, biochemistry-pathology, hysiotherapy and nursing staff can efficintly manage the institution. Proper opera ion and basic preventive maintenance nsures long and trouble free service. Over 35 percent live in rural areas in India. Hardly 10 percent can afford utilising nedical care available in well equipped hospitals. The affluent can certainly avail of the most advanced medical care from institutions having latest equipment and compotent specialists. Medical and engineering intellectuals of high competanee are available in the country to do research work in specialised institutions. A scientific and planned approach can lead to promotion of interdisciplinary work besides providing basic medical care for the masses.

Concluding, providing medical care for masses is a formidable challenge when the resources are very limited. A lot lepends on medical specialists and administrators in the management of hospitals to utilise recent techniques. Some of them like electroaerosal therapy, ion therapy, electro sleep therapy, ultrasonic therapy are really economical and can be utilised as part of outpatient services of any nursing home, polyclinic, urban or rural hospital. As far as possible, non-invasive diagnostic and therapeutic techniques are invaluable for largely populated non affluent nations. A realistic balance has to be struck by proper planning and management of the limited resources.

Bibliogsaphy

1. Krishna Murthy T.G. (1971) Development and Manufacture of Bioinstruments in India. 9th ICMBE, Melbourne, Aug. 1971.
2. Krishna Murthy, T.G. (1973)— Bioeng, Industry & Health care in India, 10th ICMBE, Dresden, Aug. 1973.
3. Krishna Murthy, T.G. (1976)— Bioengineering in Health care. 29th ACMB, Boston, Nov. 1976
4. Krishna Murthy. T.G. (1976)— Biomedical Engineering & Industry. 15th B.E.S, Conference, Edinburgh, Aug. 1975
5. Krishna Murthy T.G. (1973)— Instrumentation for hospital in. India. Biomedical Engineering, 8. 10. 435
6. Krishna Murthy T.G. (1974)— Electronics in Medicine, 3rd Hungarian BMEC, Budapest, Sept. 1974
7. Krishna Murthy T.G. (1974)— Electromedical Instrumentation in India Med Pro Thro Tec., 2.4.189
8. Krishna Murthy T.G. (1977)— Clinical Engineering & Health Care, 4th Hungarian BMEC, Budapest. Oct, 1977
9. Krishna Murthy T.G. (1977)— Instrumentation for health care in India, Med Pro Thro Tech, 5.1.35
10. Krishna Murthy T.G. (1977)— Hospital Instrumentation & Health care, Elecs, Information & Planning, 4.5.434
11. Krishna Murthy T.G. (1975)— Instrumentation in Heath care, Bioelectronics Symposiu, Ahmedabad, Dec, 1975

12. Krishna Murthy T.G. (1976)— Instrumentation-Planned Approach, Note to ICME, New Delhi, Sept. 1976

13. Krishna Murthy T,G. (1975)— Manufacture of bio-instruments in India, C. S. I. O. Communications, 2.2.24

14. Krishna Murthy T.G. (1976)— Instrumentation for hospital in In Hospital Engineering, Jan-Feb. 197

15. Krishna Murthy T.G. (1977)— Medical Electronics-India 1977, T clinician, 41, 10, 306

16. Krishna Murthy T.G. 1978)— Instrumentation for Mass Hea Care. ISWBME, New Delhi, Feb, 19

Plastic Moulding And Its Uses.

By

N. D. GHATAK D.C.M.S., A.M.I.S E ,*

Introduction

Plastic Technology plays an important role in the field of Engineering & Science in this modern era. Most of the domestic articles. Toys, Electrical apparatus, Electronics spares etc. available in the market are made of Plastic.

Plastic which is of common use in the field of Engineering and Technology may be classified into two main categories :

1. Thermo Setting Plastic.
2. Thermo Plastic.

Thermo Setting Plastic :

Thermo setting Plastic consists of Phenol-formal-dehide and urea-formal dehide.

The Phenol-formal dehide Plastics are produced by the condensation of Phenol compounds with formal dehide (A woo distillation product). The resulting syntheti resin may be utilised in powder from mixe with suitable filler such as wood flou asbestos, stone filler etc. This powder whe heated within the mould under heat an pressure first soften and takes the same shape as that of the mould and whe becomes forms hard into a solid article This can not be re-moulded. This is fir proof and brittle

This synthetic resin can also be mixe with some suitable solvent to use as varnishes for electrical insulation and decorative purposes. When several layers of laminated fabrics are affixed with this resign a relatively high strength is obtained. Thi has a good physical and mechanical properties and a high electrical insulating capacity (upto 1,35,000 volts).

* N. D. Ghatak is an Ex-Manager, Plastic Manufacturers Ltd, Calcutta
Vill & P. O. Durlavepur, Dist. Bankura, (W.B).
This paper was received on March 1971

This type of Synthetic resin is also used as adhesives. It is commonly known as Bakelite.

Backlite :

Bakelite is a synthetic product, first invented by Dr. Bakeland, is formed when equal amounts of phenole and formeldehide are heated together in presence of a base. This substance is soluble in alchol and acetone, it has a melting point of about 120° F. This material is known as Bakelite resine 'A'.

The commercial moulding power (Bakelite materials consist of resin 'A' mixed with various filler under controlled condition.

Bakelite Moulding materials (Bakelite Powder) are supplied commercially in powder state, ready for the use in the moulds. Standard Bakelite Moulding Power is available in 3 (Three) colours :— (a) Brown (b) Black, (c) Red. Special colours like green, yellow, gray, maroon etc. are als,) available. This powder may be available in the market in bag or Barrel. This powder is used for moulding Electrical parts of simple and complex design having a good electrical insulating properties. This product can be easily machined, drilled Tapped etc. This Bakelite products are mainly used for moulding Radio Cabinets, switchgears, Telephone parts, Electrical accessories. In automobile works it is used for coil ignition parts, moulding gear lever, knobs, switch, cut out, distribution boards etc.

The armatures of dynamos and motors are impregnated with Bakelite insulating varnish. This materials has a number of other application in the Electrical industry and also widely used in the other engineering industry.

Bakelite Moulding Technique.

Three types of Moulding Presses are employed for moulding Bakelite products 1) Head operated presses. 2) Hydraulic Presses 3) Trnsfer Moulding Presses.

These presses are fitted with Top and Bottom size varing 8″ × 8″ to 36″ × 36.

The pressure required to mould Bakelite Materials varies from 500 lbs to 2,5000 lbs/sq. inch of projected mouiding area depending upon the type of Moulds and shape of Moulding. All the presses should be fitted with one operating Value to Control the pressure.

The Moulds are design to use heating Cartridge (Heating element) so that the Moulds can be heated for compression Moulding Tool. Heating control units should be provided to adjust the heat of the moulding Brkelite articles.

It is advisable to use a comparatively light pressure untill the moulds is practically closed. The extreme pressure may be given and maintained untill the mould is fully closed. The time required for curing the moulding powder depend upon the size of of the moulded articles. For mould of small components 15 to 30 seconds is enough. For a Radio cabinet weighing say 5 kg. Moulding powder 5 to 7 minutes is necessary for a piece weighing say ½ oz about 1½ minutes is necessary per cycles of operation. In one word we may say that to mould a small articles more heat and less curing time is necessaey and to Mould

a big components less heat and more curing time is necessary. Pressure required 3/4 ton to 1½ ton per square inch depending upon the cross-section of the articles, quality of moulding powder (Flow of Moulding powder).

The Moulds can be heated (for compression moulding Tool) by heating cartidge (heating element) at 60 to 250 watts depending upon the design of the moulds or by steam at about 150 lbs/sq. inch pressure.

The temperature of the moulds should be 230° F to 320° F depending upon the materials to be moulded. The Bakelite powder can be feed by the help of the loading board. For certain types of moulding known as flash moulding 'Tablet' is necessary. The moulding powder are compressed to Tableting Machine and round Tablet formed. This Tablets are placed directly in the moulds or after pre-heating for impression. Special Machine known as Tableting Machine are available in the market. To avoid blister in the moulded articles pre-heating is necessary. Good quality of powder is recommended for good moulding. High frequency heater (for pre-heatiog the moulding powder or Tablet) are also available in the market.

For special moulding purposes Tablets are pre-heated in the heater for a few seconds before placing in the moulds. Care should be taken so that the Tablet do not leak at time of pre-heating.

Urea Formaldehide :

Urea which is made from ammonia and carbon dioxide is used either alone or mixed with thiourea and allowed to condense with formaldehide (a wood distillation product).

This syrup is used for impregnate wood flour and similar fillers for moulding purpose. This is a costly material. This is used for moulding decorative articles like reflectors, electrical accessories etc. This has a good physical and Mechanical properties. This has a good electrical iusulation peoperties also. This can be machined, drilled, Tapped etc.

NOTES & NEWS

Indigenous Hydraulic Leather Shaving Machine Commissioned

For the first time in India a 1250 mm wide leather shaving machine of sophisticated design and rigid construction has been designed, developed and manufactured with 100 per cent indigenous material and technology. The machine manufactured by Shalimar Engineering Works (P) Limited, Calcutta, in financial collaboration with the National Research and Development Corporation of India, New Delhi, has been designed and developed by Mechanical Engineering Research and Development Organisation (MERADO), Madras, a regional centre of the Central Mechanical Engineering Research Institute, Durgapur. In the Leather Fair recently held at Madras, this machine was awarded a special prize by the Leather Fair Society.

Robust in construction with two rigid side frames connected by tie pieces, the machine ensures accurate vibration-free shaving at all times. The machine beside being designed for high quality performance is geared for high output, and can shave upto 140 sides per hour. It is easy to operate, adjust and maintain, and is ideal for side leathers, as well as skins after chrome splitting and for completely shaving chrome or vegetable tanned leather. The skin is fed through the machine in full and taken out from the bottom. The dynamically balanced shaving cylinder gets smooth peripheral speed from the electric motor of 40 HP through universal couplings.

A standard geared motor is used for the traverse of the grinder carriage by an endless chain along the bed carrying the grinding wheel and the lubrication tank and ensures uniform grinding of shaving blades even during the shaving operation. The grinder motor is specially designed for extra compactness. A standard lubrication pump is incorporated for lubrication purposes.

In operating condition, the shaving cylinder is lifted along with its side supporting brackets by hydraulic machanism, and its position is obtained by servo machanism in accordance with the final thickness of the leather required. The hydraulic circuit for raising the support roller and driving the feed roller uses only standard components indigenously manufactured. The feeding motion is controlled by a hydraulic motor which gives an even cut and fast adjustable speeds upto 40 meters per minute. The hydraulic power pack including the built-in oil tank is compact, and is installed by the side of machine for easy accessibility for maintenance, which can be conveniently carried out without opening the machine. The use of hydraulics ensures a positive 'lock-up' of the support roller to the shaving cylinder, thereby producing a consistent thickness of cut.

The machine has certain special features built-in, which add to its versatility. Provision has been made for setting the support roller at an angle so that taper shaving can be achieved. By setting the thickness adjuster, the desired thickness of leather can be obtained in the range of 0.1 mm. 'Open' and 'close' of machine is operated through an electronic unit. The foot switch in conjunction with the above control unit operates the solenoid valves of the power pack. Provision is incorporated to vary the time

interval between successive shaving operations.

Specifications

Working width	: 1250 mm
Feed speeds	: 40 m per minute (Max)
Number of operators required	: 1
Output per hour	: 110-140 sides
Oil tank capacity	: 140 litres
Floor space required for the machine	: 3.5 m × 1.5 m
Floor space required for the hydraulic power pack	: 0.55 m × 0.9 m

Power requirements

Shaving cylinder motor	: 30 KW (40 HP)
Pump motor	: 7,5 KW (10 HP)
Grinder traverse motor	: 0.25 KW (0.33 HP)
Total power requirements	: 39 KW (approx).

Elecon Bags an Export Order for Material Handling Equipment on Turnkey Basis

Elecon Engineering Company Ltd. of Vallabh Vidyanagar—Gujrat State, the largest manufacturers of Material Handling Equipment in India who have mechanised more than 35 Coal Handling Plants and more than 15 Fertilizer Handling Plants in India—has been awarded a prestigious order valuing more than Rs. 2 Crores and 20 lacs.

The contract was awarded against stiff international competition for design, supply, erection and commissioning of Belt Conveyors, Travelling Trippers and other equipment for the bulk Sugar Terminal project of Government of Mauritius (Ministry of Agriculture) at Port Louis.

The scope of supply includes 13 nos. of Conveyors totalling more than 2 kms. in length, 3 nos. of Travelling Trippers, 16 nos. of Crane Trolley as well as pneumatically operated Tunnel Gates. 11 conveyors of 1200 mm width handle sugar at the rate of 1440 t/h and 2 conveyors of 900 mm width will handle sugar at the rate of 720 t/h.

This is a major break-through in the export market in the field a Material Handling Equipment of India.

Forthcoming Event

2nd World Hydrogen Energy Conference will be held at Zurich by the Swiss Federal Institute for Reactor Research, Wurenlingen Switzerland (EIR) in co-operation with Swiss Federal Institute of Technology, Zurich, Switzerland (ETH Zurich) and clean Energy Research Institute. University of Miami Coral Gables, Florida, U S A from 21-24 August 1978.

Further detail information may be had from the Conferehce Secretary, C/o. ETHZ Honggerberg, 2nd World Hydrogen Energy Conference 8093 Zurich, Switzerland.

Fourth International Conference

on Pressure Vessel Technology will be held on 19-23rd May 1980 at London.

Papers are invited by the Council for its technical sessions under the following list of topics ;

Group A	"General Design"
Group B	"Stress Analysis"
Group C	"Material Behaviour"
Group D	"Manufacturing Aspects"
Group E	"Quality and Reliability Improvement"

Further information may be had from The Japanese Participation Committee, Prof. H. Kiharo, President, High Pressure Institute of Japan, 4th floor, Kuroda Building. 1-11 Kanda Sakuma-cho, Chiyoda-ku, Tokyo 101, Japan.

The last for receipt of synopses will be Ist December 1978.

SOME HIGHLIGHTS ABOUT I S E

- Incorporated on August 6, 1934, it is in existence for 43 years.
- Its membership is open to Engineers and Industrialists and Technologists, Technicians and Learners alike.
- It now offers membership to respectively qualified persons in seven categories: Fellowship (F.I.S.E.), Membership (M.I.S.E.), Associate Membership (A.M.I.S.E.), Licentiateship (L.I.S.E.), Associateship (Assoc. I.S.E.), Graduateship (Grad. I.S.E.), and Studentship (Stud. I.S.E.).
- It has on rolls nearly 5000 members within the country and all over the Globe including Bangla Desh, Burma, Ceylon, Singapore. Malayasia, Middle East and African countries the U.K., U.S.A. and West Germany.
- It publishes a Monthly Journal, "SCIENCE & ENGINEERING", from 1935, commanding a circulation throughout the world.
- It maintains a Library containing above 2,000 volumes of Books and Reports.
- It has published some technical text books by noted Member-Authors, e.g. "Building Materials", & "Mineralogy, Petrology & Economic Geology" : Tables (an enlarged Third Edition of this latter work i. e. the TABLES has been recently published by the Indian School of Mines & Applied Geology, Dhanbad.)
- It conducted Postal Coaching for sometime, also a Refresher Course for Electrical Supervisor's Certificate examinees.
- Its ambassadorial services embrace Lecture Programmes, Inter-Society collaboration and exchange of ideas, delegation to national and world Engineering Congress.
- It of late has urged and brought to the notice of the Government the need for National Engineering & Technology Policy.
- It acts as a principal sponsor of the Federation of Professional Engineering Institutions of India (F.P.E.I.I.) cum the Joint Indian Engineering Council (J.I.E.C.).
- It of late has set up a BRAIN TRUST along with Technical Information Department to provide aid and guide to Operational Research and Practice in different fields of Engineering and Technology.
- It has on its record the association of eminent personalities like Bharat Ratna V. V. Giri, Late Sir C. V. Raman, Dr. Kailash Nath Katju, Dr. J. C. Ghosh, Nawab Zain Yar Zung Bahadur, Prof. Bhim Chandra Chatterjee, Dr. B. N. Dey, Air Vice-Marshal Harjinder Singh, Dr. J. N. Basu and Engineer - Administrators like Dr. K. L. Rao, Dr. T. Sen, Sri T. R. Gupta, Sri P. C. Bose, Sri P. C. Mitra, Sri S. S. Mukherjee, Dr. K. R. Chakravorty, Sri U. P. Mullick, Sri .N. Chowdhuri, Sri H. D. Bhowmick, Sri N. N. Chakrabarti, Dr. H. N. Sethna, Dr. R. Ramanna, Sri S. Samaddar and of leading industrialists like Late Shri R. L. Kirloskar of Yantrapur, Mysore, and Shri G.D. Naidu of Coimbatore.

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Popular contribution on scientific, technological, engineering industries and other allied subjects are invited for publication.

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CONTENTS

SCIENCE & ENGINEERING

Volume XXXI No. 8 August 1978

ON PRESTRESSED CONCRETE AND SHELL CONCRETE

The development of prestressed concrete and shell concrete is about 30 years old only. The very interesting paper of Mr. D. K. Das published in our Science & Engineering issue of July 1978, shows the considerable advance made in prestressed member design.

On or about 1959 work on the development of a hand operated prestressing screw jack of 5 tons capacity was taken in hand by CBRI, Roorkee in India. It was capable of tensioning two wires of 5 mm diameter. The grips developed for use with the pretressing system consisted of a male and a female cone of high tensile steel. The inside of the female cone was lined with a close coiled conical spring of the same material. Proving and calibration tests were carried out on the jack. These were first attempts in India.

In this connection we remember an interesting paper ('A prestressed screw jack' by G. S. Ramaswamy, and S. K. Narayan, that appeared in the journal of Institution of Engineers (India) XL (4), 1, 1959, dealing on vertical loading tests of a prestressed concrete truss.

In fact prestressed concrete trusses offer an economic means of roofing industrial sheds. They save steel to the extent of 75% compared to traditional steel trusses. One of the earliest practical effort in this direction was made through a comprehensive research programme on the subject initiated by CBRI on the Industrial and Factory Building Panels of the Committee on Plan Projects. The programme included experimental studies on models using the Begg's apparatus, and photo eloaticity tests to destruction on full-scale trusses, and a field experiment involving construction of a pavilion incorporating prestressed trusses for the Bengal Engineer Centre at Roorkee. Two full scale trusses of 40 feet tested to destruction showed the average load factor against failure, was 3.71.

With the progress of prestressed concrete research in India led by CBRI, an important prestressed concrete foot-bridge across the Ganga Canal at Roorkee was taken up for a span of 175 feet (53.34 metres) by the U.P. Irrigation Research Institute, with design assistance from the CBRI (Central Building Research Insititute).

The recommended design consisted of a single T beam 76" (1.93 metres) deep, prestressed with 21 cables of 12 nos of 7 mm. wires at the middle of the span. Much water has ofcourse now flown down the Ganges in the matter of prestressed concrete design and use.

It is well to remember here that one of the earliest design efforts to develop prestressed trusses, was a 1/16 scale perspex model of a 40 feet, (12.19 metres) precast truss with prestressed tie analysed by using Begg' Deformator, and influence lines drawn for the force in each member, and the moment and transverse shear at the ends. The object of the investigation was to assess the nature and magnitude of the secondary effects caused by the rigidity of the joints and the prestressing itself. These effects were found to be of no consequence, except in certain members. The conclusion was that a safe method of designing such trusses would be to regard the members to be pin-pointed at the ends. Only a few members needed to be checked and designed for seoondary effects.

The formula that was proposed for incorporating in the proposed Indian Code of Practice for prestressed concrete recommended on the basis of tests, was $E=7.815\times 10^6 \left(\frac{f_c}{f_c + 1700}\right)$ in lbs/sq. in, where $E=4.17\times 10 + 300\ R_c$ in lbs/sq. in, and f_c and R_c were respectively the cylinder and cube strength of concrete at 28 days.

Research work on shells of double curvature in the form of a Prandtl Membrane was also developed about the same time in India, resulting in the development of a shallow shell of double curvature whose height Z_1 at every point satisfied the Poisson's equation $\triangle^2 Z' =$ constant.

Processes were developed for precasting such shells in small units under special methods for use in roofs and floors. Studies were made to extend their use for covering large column-free areas required for industrial and storage structures. For this application, shells were cast in situ over forms conforming to the shape of a Prandtl-Membrane in soap bubble described over the boundary. As such structures were mostly rectangular in plan, tables were compiled for calculating the height of the shell for rectanlges with various ratios of the sides.

Another simple method was developed for use when the boundary was not a familiar geometrical figure. It consisted in making a mould whose plan was geometrically similar to that of the prototype. A piece of hessian being stretched across the mould, the fabric was allowed to sag under the weight of an uniform layer of concrete. On inverting the model after 24 hours, the heights, of all points were scaled off, and the corresponding heights of the prototype arrived at by similar proportion. This method gave results which agreed very closely with the values calculated by the Relaxation Method. An experimental structure of this type was used 22½ ft

45 ft (6.86 m × 13.72m), with 2″ thick (50.8mm) shell, except at the edges, where the ickness increased to $3\frac{1}{2}$″ (809mm). Only nominal reinforced of $\frac{1}{4}$″ (6 35 mm) diameter ırs at 9″ centres placed bothways proved sufficient, the spacing being $4\frac{1}{2}$″ 4.3 mm) at the edges. The shell was stiffened with edge beams resting on masonry alls on four sides.

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A further advantage found in shell structure of this type was that taking lvantage of the low compressive stresses in the shell, it was possible to demould ıe shell at the end of 4 days only, resulting in a quicker turn over of the form work.

For cylindrical type of shells work was also taken up in India about this me, on the influence of the size of the edge beams, on the stress resultants ı cylindrical shells, the object being to establish criteria that could help the designer ı the selection of the edge beam sizes.

Suitable designs for inverted umbrella-type hyperboloid-paraboloid were also eveloped for skeletal houses for industrial workers. This type of roof lends itself leally for such applications, especially where large number of repetitions of identical nits are involved. This type of roof has also since been used for factory roofing vith success. Analytical study on the type of boundary conditions that could be prescribed for a hyperbolic-paraboloid were also completed.

The International Colloquium on the Construction process for Shell Structures, Madrid, 1959, The 'Analysis of Northern light Shells' by G. S. Ramaswamy and M. amaiah, in Indian Concrete Journal 33 (12) 1959, and the 'Analysis of the General Iyperbolic Paraboloid Shell' by M. N. Keshava Rao, in Indian Concrete Journal 3 (12), 450-454, 1959 are in this connection worthy of notice. Indian engineers like Mr. Chatterjee of M/s Chatterjee & Polk, and Mr. S. P. Banerjee have done also much ecognisable advanced work in prestressed concrete and shell concrete structures and their designs.

Environmental Control and Related Problems

By

A HALDAR*

SYNOPSIS

The paper discusses and deals with the problem of Environmental Pollution. Historical backgrounds and Human consciousness to control it through control measures and legislations are described in brief. The paper further aims at knowing sources and causes of pollution with its various Effects on Human Health and Visibility ; Animal health and Growth of Plants and Vegetables ; Sea Water Quality and Materials ; Deterioration of Production, Quality, Services and Industrial Relations. Cross-section of Individual harmful pollutant is tried to be outlined with special reference to the outstanding effects on Mankind.

Introduction

"Environment" precisely may mean something that environs or surrounds or encircles, It is the complex of climatic, edaphic (relating to the soil) and biotic (relating to life) factors that act upon an organism or an ecological community and upon an organism or an .ecological community and ultimately determine its form and survival. Environment also means the aggregate of social and cultural conditions that influence the life. Emphasis however has been given here to the First meaning since the latter may seems to be beyond the scope of present discussion.

* A Haldar, Manager, Design & Development. Hindusthan Development Corporation Limited.

** Paper presented at the Paper Meeting on "Environmental Control & Related Problem" on June 23, 1978 at India Society of Engineers, 12-B, Netaji Subhas Road, Calcutta-700 001

"Environmental Problems" thus lead to the problems faced by our earthy environment due to "Pollution", a word, fifty years ago which would have raised everyones eyebrows. Today this is household one amongst children in kindergarten to old persons over eighty.

Environmental Problem is caused due to our atmosphere or surroundings of any material which has a harmful effect to life upon earth. As life is again connected with air or precisely oxygen, problem is caused by any pollutant, which when put into atmosphere, either purposely or through some acts of nature, reduces oxygen content or significantly changes the composition of the air. Pollution is a result of technological progress and of human activities and can be as dangerous to threat life. It is again unavoidable (though controlable) with the

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Then also it was found that the surface being doubly-curved and non-develop-ble, there was little danger of buckling. A thickness of 2″ (50.8 mm) was found dequate to cover areas as a large as a 1000 square feet (92.90 sq. metres).

A further advantage found in shell structure of this type was that taking dvantage of the low compressive stresses in the shell, it was possible to demould he shell at the end of 4 days only, resulting in a quicker turn over of the form work.

For cylindrical type of shells work was also taken up in India about this me, on the influence of the size of the edge beams, on the stress resultants n cylindrical shells, the object being to establish criteria that could help the designer n the selection of the edge beam sizes.

Suitable designs for inverted umbrella-type hyperboloid-paraboloid were also eveloped for skeletal houses for industrial workers. This type of roof lends itself leally for such applications, especially where large number of repetitions of identical nits are involved. This type of roof has also since been used for factory roofing 'ith success. Analytical study on the type of boundary conditions that could be rescribed for a hyperbolic-paraboloid were also completed.

The International Colloquium on the Construction process for Shell Structures, ladrid, 1959, The 'Analysis of Northern light Shells' by G. S. Ramaswamy and M. amaiah, in Indian Concrete Journal 33 (12) 1959, and the 'Analysis of the General yperbolic Paraboloid Shell' by M. N. Keshava Rao, in Indian Concrete Journal 3 (12), 450-454, 1959 are in this connection worthy of notice. Indian engineers like Ir. Chatterjee of M/s Chatterjee & Polk, and Mr. S. P. Banerjee have done also much cognisable advanced work in prestressed concrete and shell concrete structures and eir designs.

Environmental Control and Related Problems

By

A HALDAR*

SYNOPSIS

The paper discusses and deals with the problem of Environmental Pollution. Historical backgrounds and Human consciousness to control it through control measures and legislations are described in brief. The paper further aims at knowing sources and causes of pollution with its various Effects on Human Health and Visibility ; Animal health and Growth of Plants and Vegetables ; Sea Water Quality and Materials ; Deterioration of Production. Quality, Services and Industrial Relations. Cross-section of Individual harmful pollutant is tried to be outlined with special reference to the outstanding effects on Mankind.

Introduction

"Environment" precisely may mean something that environs or surrounds or encircles, It is the complex of climatic, edaphic (relating to the soil) and biotic (relating to life) factors that act upon an organism or an ecological community and upon an organism or an .ecological community and ultimately determine its form and survival. Environment also means the aggregate of social and cultural conditions that influence the life. Emphasis however has been given here to the First meaning since the latter may seems to be beyond the scope of present discussion.

"Environmental Problems" thus lead to the problems faced by our earthy environment due to "Pollution", a word, fifty years ago which would have raised everyones eyebrows. Today this is household one amongst children in kindergarten to old persons over eighty.

Environmental Problem is caused due to our atmosphere or surroundings of any material which has a harmful effect to life upon earth. As life is again connected with air or precisely oxygen, problem is caused by any pollutant, which when put into atmosphere, either purposely or through some acts of nature, reduces oxygen content or significantly changes the composition of the air. Pollution is a result of technological progress and of human activities and can be as dangerous to threat life. It is again unavoidable (though controlable) with the

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resent industrialisation, as most interestıgly the very word "INDUSTRY" contains DUST" as its very own constituent, which is not merely a coincidence.

Historical Background

There are references to Pollution in the Bible. Historically air pollution dates back 273, when English people enacted a law to prevent air pollution through burning soft coal. In 1661, John Evelyn published his well known pamphlet "FUMIFUGIUM" on the "Inconvenience of the Air and Smoke of London Dissipated". During Mediaeval period. King Edward of England signed the first air pollution law "The Sea Coals Act". Water Pollution bill was in existance during ROMAN Empire.

However, true conciousness started only from early twentith century and peoples in U.K., U.S.A., and other developed countries came forward to enact various legislations and take Control Measures. Chronologically, the following entries would be of interest.

TABLE—1

Court Proceeding/Association/Act	Country	Year of Introduction
Court received and examined Report that "many persons of writable lungs find unquestionable inconvenience from these mechanical impurities (i.e., sulphur and fumes of sea coal) of atmosphere".	U. K.	1854
Smoke Prevention Association	U. S. A.	1907
USA Congress first considered Environmental Regulation Authority with Federal Pollution Control Act.	U. S. A.	1948
First National Air Pollution Control Legislation enacted.	U. S. A.	1955
English Clean Air Act (after Air Pollution Episode in London in December '52, causing estimated death of about 1600.	U. K.	1956
Federal Water Pollution Control Act (Amendments)	U. S. A.	1956
Motor Vehicle Air Pollution Control Act.	U. S. A.	1964
Clean Streams Act.	U. S. A.	1966
Air Quality Act.	U. S. A.	1967
Clean Air Amendments	U. S. A.	1970
National Air Quality Standard Act	U. S. A.	1970 (4th March)
Tax incentives Accepted on Clean Air Act.	U. S. A.	1975

Indian Conciousness-Legislation & Standardisation Measures :

Compared to above advanced countries, we may, at the outset, feel happy with our efforts through legislations and standardisation measures on environmental pollution control in India are restricted within theoretical arena. Coal Mines Regulation regarding Mine Ventilation formulated in 1957 and during the period 1960-65, several Air and Environmental Control Authorities started functioning. Water Pollution Bill became effective from 1969 and in 1969, ISI published various standards on Pullution Measurement. National Committee on Environmental Behaviour formed during early seventies. In 1978, Air Pollution Bill has also been passed by the Parliament.

Sources and causes of Pollution

Environment is getting polluted by numerous pollutants every seconds and these pollutants may either be of Toxic gaseous hydrocarbons, Particulate irritants, Photochemical Oxidants, Gas and Particulate smog or from Sound and Atomic radiation.

Pollutants may be divided into the following broad groups :

a) Dusts, Fumes, Mists, Aerosol, Smoke (particularly "black" one produced by incomplete combustion of carbonaceous fuels) and other particulates.

b) SO_2, HF (or H_2F_2), HCl, NO_2, CO, Chlorine, H_2S, NH_3,

c) Sound Pollution—By Jet Engines)

d) Photochemical Oxidant—This was recognised after 1940 and characterised as "An unusual odor, intense eye irritant and highly restricting eye visibility". This is also popularly known as "LOS ANGELES SMOG". Since 1950, photochemical air pollution has been in prominence.

Though deterrioration of Environmental quality began no sooner man first utilised fire, due to so many factors and acts, present trend is to charge mainly and may be, in general, only Industry, but fact would state, wastes from industry today contribute only about 15-20% to our total pollution problem.

Main source may rather be internal combustion engines in automobiles, buses, trucks, airplanes and other modes of transports, contributing as high as 50-60%. Generation of electricity for peoples ultimate comfort contributes 10-15% whereas Domestic heating is held responsible for about 10%.

Table 2, as given below shows the comparative coverage of total pollutants, as estimated, in U.S.A. and India.

Table 2

Events/activities	U.S.A (%)	India (%)
Transport/Vehicles	50-60	40-45
Electric Power Generation	10-15	8-10
Domestic Heating/Coal Burning	10	10-12
Industrial Fuel Consumption and Process Emissions	15-20	20-25
Refuse Burning/Spreading	5	2-3

Since our Society is not static, above figures obviously are not also static and should be taken as indicative one.

In case, we take Industrial Process Emission alone, the following break-up

ould again represent approximate sub-roupings (based on U. S. A. statistics) :

Table 3

Industrial Processes	Emission %
etroleum Refining	15-16
melters-Aluminium, Lead, opper, Zinc etc.	15-16
ron Foundries	14-15
raft, Pulp, Paper Mills etc.	13-14
oal Cleaning & Refuse	9-10
oke (used in Steel Manufacturing)	9-10
ron & Steel Mill	7-8
irain Mills, Storing, Handlings	4
ement Manufacturing	3
extiles, Jute Mills etc.	2-4
oosphate Fertilizers	below 1

As Industrial processes represent broad ay-lights' defaulters, they attract maximum riticism for Environmental Problems and forts are being all directed to force Industry or affecting various control measures and o bring various Industrial Pollution Control egislation. Above, it is certain, however, lone cannot solve the problem, so long overall consciousness does not evoke. As with other major sociological issues, one, while talking about Environmental problem due to Pollution, cannot further separate fact from emotion. This also has to be avoided so far practicable and logical approach would be necessary to find out sources and causesof Pollution and side by side remedial measures.

Condition of Indian Cities Compared to Advanced Countries Like U. S. A.

As per N.E.E.R.I. Survey during 1971, Madras comes out to be the cleanest city in India, but carries three times dust loading when compared to its counterpart in U S.A., namely, Honolulu. Delhi and Kanpur are too much dusty. While Delhi gets its contribution from city's busy transport system and nearby power plants and other industries, Kanpur happens to be in excessive dust due to extensive use of coal in domestic use and textile mills. Calcutta is having about three times dust loading with respect to New York city's average dust loading value. Further, Calcutta and Howrah becomes more dusty during winter season. The following Table 4 would lead to us to the "dusty" problem faced by our big metropolies/cities compared to those in U.S.A.

TABLE 4

City	Country	Suspended Particulates ($\mu g/m^3$)	Value of SO_2 ($\mu g/m^3$)	Source
Calcutta		340.7	32.88	NEERI
Bombay		240.8	47.11	Survey
Delhi		601.1	41.43	1971
Madras		100.9	8.38	
Kanpur	INDIA	543.5	15.97	
Nagpur		261.6	7.71	
Ahmedabad		306.6	10.66	
Hyderabad		146.2	5.06	
Jaipur		146.1	4.15	

		AGM	Max.	
New York		124	252	1969
Washington D.C.		72	216	National
Chicago		114	273	Study
Buffalo		117	1321	(AGM=Annual
Honolulu	U.S.A.	33	74	Geometric Mean)
Los Angeles (California)		113	235	
Charleston W (Vargenia)		174	684	
Birmingham		128	329	

Amount of Pollutants Pouring into Calcutta City :

Over 600 tons of pollutants including about 60 tons each SO_2 and other oxides of N_2 are generated per day in Calcutta—by Industrial coal/fuel burning, domestic coal burning and vehicle emmission.

Out of above, suspended particulates count about 45% and CO about 28%, 20% being from city's Traffic system. Smoke coming out from over a few lakhs of domestic ovens makes Calcutta evening a real 'heavy' one. Problem becomes worser here due to Gangetic Plain Climatology i.e. high humidity and low air current. Recent survey measures Calcutta dust fall as 10 to 39 tons/sq. km/month whereas Howrah receives 8.6 to 39 tons/sq. km./month. In Bombay, dust settles upon Chembur area at the rate of average 25 tons/sq.km./month.

On comparison, as per 1961 survey, U.S.A. dust fall ranges from as low as 4.3 to as high as 396 tons sq. km/month.

Effects of Environmental Pollution :

Amongst the numerous harmful effects, the following may be classified as major ones and are discussed in the following chapters in details :

i) Human Health and Visibility.

ii) Animal Health and Growth.

iil) Plants and Vegetables.

iv) Damage to Materials.

v) Deterioration of Production, Quality, Services and Industrial Relations.

vi) Deterioration to Sea water Quality.

Effects of Pollutants on Human Health and Visibility :

Polluted environment is affecting human health and visibility in so many ways. Mostly eye, nose, and throat irritation ; headache and allergies ; nausea and others ; respiratory disease (T.B.) ; bronchities and lung Cancer ; physiologic stress on heart patient ; common cold and influenza ; asthma, tonsillities and poor visibility are caused and become acute due to polluted environment. In Calcutta, over 50% of residents are suffering from respiratory diseases due to Air Pollution, as revealed in a survey conducted by C.M.D.A. with N.E.E.R.I collaboration.

An average man breathes 22,000 times y and takes in about 16 kg. of air. Pure as we all know, contains 78.09% by ume of N_2, 20.99% of O_2 and 0.9% of on as major constituents and in compa- n. if SO_2 and CO_2 exceed only 0.03 and 0 % by volume, they endanger human "Medical Effect of Pollutants on the man Body", as given below, based on ifornia State Public Health Deptt. ervations begining April 1956 and con- ing for 5 years would be interesting note.

Table—5

	Due to Air Pollution %	Due to other weather conditions %
complaints	54	3
thma	34	22
se complaints	29	18
roat complaints	28	12
ergies	15	11
ghing	12	10
l Headaches	11	5
spiratory diseases	11	10
est pains	10	4
eling tried and low	5	5
omach complaints	2	below 1

figures are count of reporting a change condition)

In recent past a survey has been under- ken in Kanpur, one of the most polluted ies, and it has revealed that particulates more dangerous for health. Table 6 below uld speak for it.

Table—6

fect of Different Pollutants on Health

seases	SO_2	Oxides	Solid Particulates
mmon Cold	Medium	Medium	Extreme
luenza	Low	Low	Extreme
Bronchities	Extreme	Medium	Extreme
Respiratory Diseases	Medium	Medium	High
Asthma	Low	Low	High
Tonsillities	High	Low	Extreme

(Co-relation Coeff. Low : 0.004-0.10 ; Medium : Above 0.10-0.20 ; High : Above 0.20-0.30 ; Extreme Above 0.30-0.60)

Effect of Individual Harmful Pollutant on Human Health :

Table-7 below represents further indvidual effect of main pollutants on human health :

Table—7

Pollutants	Dangerous Limit $\mu g/m^3$	Effects
Particulates	>80	Increased death rate over 5o years
	>100	Respiratory/Lung diseases and increased illness of older persons with Chronic bronchities.
	>150	Poor visibility
CO	>12-17	Exposure of 8 hours raises Blood Carboxy-hemoglobin level to 2-2.5% even for non-smokers.
	>35	8 hours exposure brings Physiological stress in heart patients.
SO_2	>115	Bronchities and Lung Cancer.
	>286	Visibility reduced to 5 miles.

	SO_2 >300	Exposure of 3-4 days results Hospitalisation and Group absentism.
Nitrogen Dioxides		Lung Disease, Pathological change, Bacterial Pneumonia.
Photochemical Oxidants		Aggravation of Asthma attacks, Eye Irritation etc.

Size of Harmful Partculates

Particulates over 5 to 10μ do not reach 'Lung' due to in built mechanism of human breathing system. Particulates of size below 5μ are definitely harmful and cause various health hazards. C0 is, by far one of the greatest air pollutants, hazardous to health. It has effect on 'Central Nervous System' in concentration as low as 10 ppm. (parts of gas per million parts of air).

Animal Health and Growth

Most prominent damage is caused from areas where grasses are contaminated by Fluoride Dust. If toxicity exceeds the given below limits, then accumulation of fluoride in bone structure leads to weight loss and even lameness.

Species	Diary Cow	Beef Cow	Sheep
Soluble Fluoride ppm F.	30-50	40-50	70-100
Species	Chicken	Swine	Turkey
Soluble Fluoride ppm F.	150-300	70-100	300-400

It has been found, that animal's growth has been restricted and some times resulted in body abnormality due to pollution effect-

Plants and Vegetables :

Grape leaves go rotton from ends due to fluoride accumulation. Roses become dry, crisp and small due to naturally accuring air pollutants (possibly Ethylene) and Tomato plants get damaged due to SO_2.

Pollutants originate mainly from use of pesticides and insecticides ; synthetic chemicals as used for fungus and other bacteria keeping. India uses above chemicals in proportion of 160 gm/hectors whereas in U.S.A., it is 2500 gm/hectors.

The interesting point is that solid pollutants easily get deposited on forests and green fields and thus cannot attact human life in cities that much. Thus, as in other so many ways, plants save human souls sacrificing themselves and from this, we have the slogan "Grow More Trees, Save Mankind".

Effect on Materials

Damage to materials is one of the costliest effect of pollution. Due to pollutant's high corrosive nature, added with other effect, materials are very weak in front of it. It can have several dangerous effects. It may not be far back to remember collapsing of foundry roof at Rourkela Steel Plant! One of the main reasons being excessive dust deposition upon roof-top.

Recently, "Tajmahal" has been in danger due to pollutants and turbulance has reached upto highest authorities to stop this. Mathura Refineries have also been questioned as the major pollutant source. On other front, material thickness loss makes concern all round and requires extra provision for (i) Sea going vessels and ship

) Chimneys and tanks etc. as per ındards.

Cracking of nearby structures, glasswares c. somehow restrict the commercial use "Concord" plane though its tremendous hievement to beat times by speed is a ıenomenon now-a-days.

ffect on Production, Quality, Services and dustrial Relation :

Eye irritation brings loss in Electronic ssembly Industries. Low visibility brings ccidents in traffic and industries. Smog ıd Fog hamper plane aviation and make nding and take-off dangerous as well as costly. Toxic gases brings more diseases, aking absentism and loss of man power Textile and Chemical complexes. Quality so gets detoriated due to above effects as bours easily develop fatigue, stress and be- ome prone to negligence. Further, clean en- ronment and working atmosphere is the key ord for good and healthy industrial elation. Now-a-days due to pollution and s irritating effects more industrial unrests an be noticed in Textile Mills, Jute Mills, hemical complexes etc. rather than offices, ıstitutions etc. Reported loss of health nd span of life in Tannery, Textile and veaving Mills and also exerts a phycological ressure and strain on workers causing ndustrial unrest.

)eterioration to Sea Water Quality

It would be interesting to note, less than % of the estimated world water reserve s available to man as fresh water. In India ve are dependant on rainfall and most of vailable water is of low grade, useable uantity of water is estimated at less than) 3%.

Sea water is polluted by various wastes are dropped from Vessels and ships ; or as borrowed by various rivers. They, in turn, collect various industrial and chemical wastes from nearby industries.

Further, radio-active substances from neuclear test etc. also settle down and mix up with open water and thus makes it harmful for animals, fishes etc. Growth of fish gets hampered due to above and on various occasions, it has been reported that a whole gang of fish has come up on water surface as dead.

Inter-Continental Movement of Pollutants

Pollution problem has ceased to be restricted within the boundary wall of any particular country or even continent and become universal in its true sense. Natural phenomenon has helped it to gain above fame and for instance, it may be recalled in February, 1903, air current carried 10 million tons of Red Dust from North West Africa and deposited in England. Distance is not at all a criterion for Pollution threat.

Conclusion

Nation can have its boundaries, can have its own customs, ways of life etc. but one thing is common that all nations are sharing the same environment of this earth or, in a greater meaning, universe. Atmosphere doesn't have any boundaries and as such, pollution hazards of one nation or even one continent can attack other ones. There are numerous ways and these cannot be stopped by putting up any "Chinease Wall". The only other way left is to arise consciousness, adopt proceedures to check pollution and work unitedly. Environmental pro-

blems have threatened mankind with nemerous adverse effects already documented while many others may probably still unknown.

We know, with consciousness, the problem is the result of unavoidable side effects of our present civilization as for thousands of years until the last two centuries : Industrial advancements, nature and climate had probably not lost their purity appreciably.

Man, no doubt, is the creater of all of his own problems but, supremacy of mankind over their living beings remains unchanged as only man; by virtue of his own talent finds a full proof solution of his own problem too. Time has come to rise to the need of the hour and put all efforts unitedly to see threates to manking arising from our own created devil 'Environmental Pollution' get resolved or at least are kept below than tolerable limits.

BIBLIOGRAPHY

1. Industrial Pollution Control Hand Book—Edited by Herbert F. Lund.
2. Air Pollution and Industry—By R. D Ross.
3. Air Pollution by W. L. Faith & Arthur A. Atkisson, Jr.
4. Journal of "Indian Association for Air Pollution Control" Vol. 1—January 1978.
5. "Environmental Control—Consciousness in India" by A. Haldar ; published in Chemical Age of India, Vol. 27, No.1 January 1976.

Simplified Method to Calculate Catenary Hanger Length

By

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A simplified method to determine catenary hanger length of an electrified railway trolley system.

There are many techniques and solutions which are available to determine catenary hanger lengths for trolley lines. Unfortunately most of them involve tedious calculations. An electrical locomotive receives power by making continuous electrical contact with a high voltage transmission line (trolley) which is strung above the centerline

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the railway track as shown on Figure . 1.

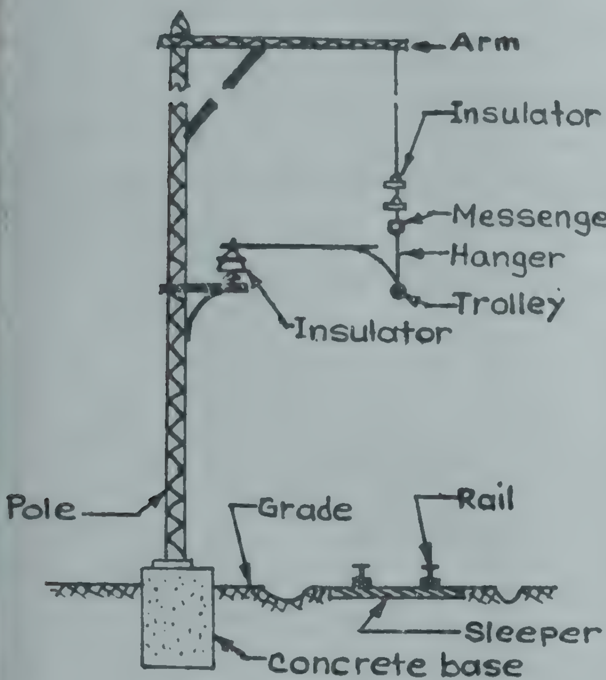

FIGURE 1

For proper electrical contact between olley and locomotive pantograph, trolley ust have as little variation as possible. For typical electrified railroad system, trolley enerally suspended by several small iameter hangers from a supporting cable alled a "messenger" as shown on Figure Io. 2.

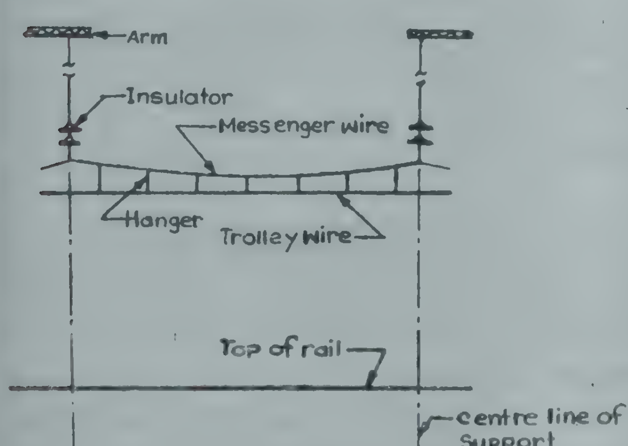

FIGURE 2

For appropriate electrical contact between pantograph and trolley, the length and spacing of these hangers must be determined to provide a straight line configuration of all support points of the trolley, so that the trolley can lie in a straight line parallel to the top of the rail (Figure No. 1). To achieve this requirement for a trolley, a simplified method is described herein for a two-wire trolley system.

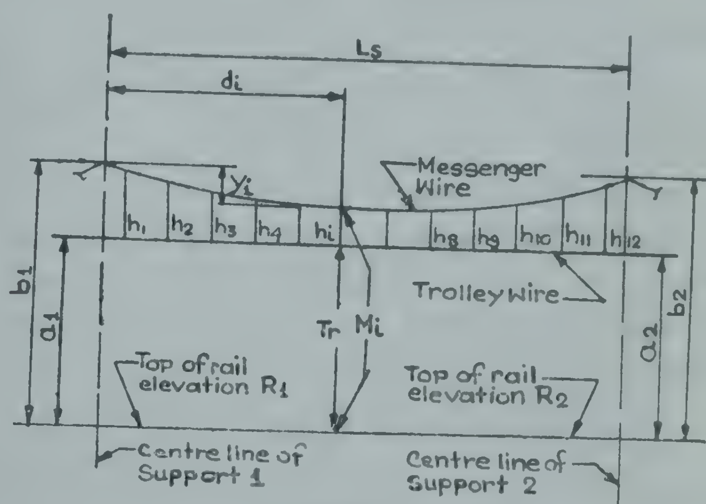

FIGURE 3

Figure No. 3 shows problem parameters for a two-wire catenyry system—a trolley (contact wire) and a messenger (supporting cable). Finding the center to center distance between trolley and messenger is an integral part of the design process. To start the hange length calculations, the track gradient, spar length, elevations of messenger and trolley at the ends of the span and wire tensions should be known. A temperature of 60° F should be considered for calculation ot hanger lengths. The load on the messenger includes weights of messenger, hangers, trolley, associated hardware, wind and ice effects (ice effect should be considered where applicable). Sag and tension for the messenger and hanger are usually

performed with standard calculations, assuming a uniform load per foot of span.

In a simple calculation, we know that hanger length at i^{th} hanger location can be calculated by

$$h_i = M_i - C_i \text{ where} \tag{1}$$

M_i = Elevation of the messenger at i^{th} hanger,

h_i = Length of hanger at i^{th} hanger location, and

C_i = Elevation of the trolley at the i^{th} hanger.

Since the trolley is assumed to lie in a straight line, therefore, the elevation of the trolley at the location of hanger i^{th} can be readily calculated from the geometry of the span :

$$C_i = R_1 + a_1 + \frac{d_i\ (a_2 - a_1)}{L_s} \tag{2}$$

where :

R_1 = Elevation of top of rail at support 1,

a_1 and a_2 are shown on Figure 3, and

d_i = Distance from support 1 to the i^{th} hanger,

L_s = Span.

In accordance with the book "Elementary Structural Analysis"; by C. H. Norris and J. B. Wilbur, as published by McGraw-Hill Book Co. 1960; we can easily calculate the value of M_i. At uniform load :

$$T_{yi} = \frac{W_{di}}{2}(L_s - d_i) \tag{3}$$

$$y_i = \frac{W_{di}}{2T}(L_s - d_i) \tag{4}$$

$$M_i = R_1 + b_1 + d_i\ \frac{b_2 - b_1}{L_s} - y_i \tag{5}$$

where :

W=Uniform load pounds per horizontal foot.

y_i =Distance between chord joining messenger attachments and messenger, and

T=Tension in Messenger.

Utilisation of Recent Techniques in Therapy

By

T. G. KRISHNA MURTHY*

In highly populated non-affluent developing and under developed nations, there is need for the utilisation of non-invasive therapeutic techniques which are economical both from the patient's as well as medical institution's view point. It is fortunate that some of the recent therapeutic techniques involve little monetary investment. Most of the devices are simple and battery operated. Effective clinical utilisation depends on the attitude of the medical profession which is in general rather conservative

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is reluctant to change over from blished methods. Equally important is lic education and acceptance. Edeicated perseverant efforts are inevitable and ntifal for the introduction of new niques. Some devices are mentioned his brief note. Most of them have been keted and the feed back from the lical profession makes one optimistic ut wider clinical utilisation in the years ad.

A number of useful prosthetic devices e been developed and have proved luable in the therapy handicapped abilitation is a gigantic social problem India. This includes the physically dicapped, speech-hearing disorders, avioural disorders, psychosomatic ess, heartblock etc., Safe, simple and nomical devices have been developed techniques evolved to give relief. A ntific and planned approach is an essen- factor to ensure the success of the nique. One should not expect specta- r results. In fact these are long term apeutic methods ranging from 12 to 24 ks of 15 to 60 minutes duration daily treate ailments which have not responded l other established routine methods. rtain devices like the implantable pace- kers, hearing aids are life time devices ose utilisation has become routine.

Sleep is an accepted form of therapy in nical practice and drugs have been ised to induce sleep. The drug dosage s regulated depending on patient ndition. Long term sedation led to diction besides other side effects. The e, simple and economical electronic hnique which can be utilised as part of any nursing home polyclinic or hospital (urban or rural) hold out great hopes to treat a wide range of ailments including hysteria, anxiety, insomnia. The unit, battery or mains operated costs about Rs. 1,000-00 has been marketed. In general current intensity from 0 to 1 milliampere and P.R.F. of 30 to 100 c/s (rectangular Pulse duration about 2 milli second) with provision for d.c. bias form the instrumenta- tion. A number of electrode placements have been clinically tried and the eyelids- hape and eyes-occuput have achieved wide acceptance. The duration of therapy ranges from 40 to 90 minutes and the number of sessions range from 20 to 40 depending on patient response. Some patients may go to sleep during the session and some may not. However the overal clinical improvement is what ultimately matters and the technique appears to slowly finding acceptance.

A number of techniques and devices have been developed to correct speech disorders. A simple battery operated device has given highly encouraging results in the therapy of severe stammerers. Sta- mmering is a great social handicap and any technique to treat the handicapped must get due attention and planned clinical utilisation. In a majority of these therapies, besides acceptance by the profession. pro- per patient briefing is pre-requisite to achieve good results. The technique consists ot applying a masking tone biaurally to ears of the stammer by means of earpieces. The technique may be planned in two stages of 12 weeks each. The first stage consists in practising reading (preferably mother tongue) continously for about 15 to 30 minutes every day with the masking units

on. The second stage of equal durations consists in conversation with the unit on. The improvement can be observed by means of a tape recorder recording the patient's speech before start of the therapy and at intervals of 4 weeks. Severe stammering cases have responded well to this form of theray.

A number of devices have been developed for use in behaviour therapy as correctives. One such device is to develop a sense of aversion for excessive habits like drinking, smoking, homosexuals. The technique consists in applying a safe but painful stimulus to the addict to associate pain with is excessive habit. A number of sessions and also the patient confidence that he will improve, have given good results. This is another new technique that is gradually finding wider clinical acceptance. The cost both from the insitution's (cost of unit is about Rs. 1,000-00) and patient's is reasonable and within the reach of many.

The beneficial effects of high concentration of negetive ions is well known. Environmental conditions highly influence the behaviour and performance of human. Normally, the ratio of positive to negetive ions in the atmosphere from 1.2. to 1.5. In view of the tranquilising effects of higher concentration which can be artificially generated, a number of ailments may be treated. The major applications have been in the preventions of infection in hospitals and treatment of respiratory allergic diseases. Both individual ionisers and room ionisers for group therapy have been marketed by MEDICOR after three decades of sustained research efforts and clinical trials.

The last decade has seen the almost routine utilisation of implantable cardiac pacemakers. Even, in a poor country like India, over 1500 have been implanted so far. (out of nearly 250,000). The prohibitive cost (Rs. 6000-00) of the unit has restricted its utilisation. To enable more needy persons to benefit, MEDTRONICS have marketed an implantable costing about Rs. 3750-00 exclusively for use in non-affluent nations.

The treatement and rehabilitation of physically handicapped involves utilisation of mechanical devices appliances besides ultrasonic therapy, diathermy, etc., Myelectric control of prosthetic devices is receiving great deal of attention. Massagers, infrared lamps, battery operated neuro muscular stimulators are extremely useful devices already marketed and within the reach of many in view of the reasonable cost.

Concluding, only some useful devices and techniques out of the many are mentioned in this brieft note. Noninvasive therapeutic techniques are of immense value to the ailing in nonaffluent nations.

BIBLIOGRAPHY

1. KrishnaMurthy T.G.—Electronic Devices in Mental Health Care. 10th ICMBE DRESDEN, Aug 1973.

2. Krishna Murthy T.G.—Sleep-Electronic Method of induction. 10th RMBES BOULDER, May 1973.

rishna Murthy T:G.—Electrosleep Technique. 4th CMBE-SC, WINNIPEG, Sep. 1972.

Krishna Murthy T.G.—Electronic aids for suppression of stammer. 3rd IC-MP, GOTHENBURG, Aug. 1972

Krishna Murthy T.G.—Electronics Aids for Humandis ability. Biocontrols system seminar, INDORE, Oct. 1972.

Krishna Murthy T.G.—Surgical implants inportance of quality assurance. 5th AICQC. HYDERABAD. Dec. 1976

7. Krishna Murthy T.G.—Implantation of Pacemakers in India. International symposium on Pacemaking, TOKYO Oct. 1976

8. Krishna Murthy T.G.—Negative Ion Therapy Indian Practitioner, 27 11,535-36.

9. Krishna Murthy T.G.—Electronic Devices in Therapy. JCMAI 11, 12, 469-471

10. Krishna Murthy T.G.—Some useful therapeutic techniques. To be published.

WOLLEN CARPET INDUSTRIES

By

RAKESH COOMAR D,H T., L.T.It, MISE.

Charter Textile Techanlogist *

Carpet industries in India plays a very ortant role in the Economic devevlopt of the country by providing the loyment to workers and earning the ign exchange. This industry is recogniged over the world for its skilful and artistic Craftmenship. In the olden times kings and richmen has patronised this trade for maintenance of their dignity of their courts.

During the Mugal period this industry was enjoying with full youth because there was no competition of marketing. When the machine made goods appeared in the market those were cheaper in comparison to hand made goods resulting into shrinkage of

* This paper was received on May '78

market potential for carpet craft and consequently un-employment among the craftsmen. In the year 1828 when machines were introduced in India, mechanic made Carpet indusry ruined the craft.

After independence the Govt. of India has given the silven lining to this craft by tadopting the various development programme and facilities such as increasing the production and training methods.

Among carpet weavers many craftsmen are now availing these facilities and hope to revive the old Craft again.

During the last five year India has earned Rs. .40 Crores as foriegn exchange from carpents.

There are Two types of the Carpets:-

1. Carpet which form the part of bedding.
2. Carpet which are put on floor mainly at place where large number of persons assemble in public meeting, marriages religious gathering, etc.

Carpets for common use are made of Cotton. Two type of Cotton Yarn are needed for weaving of Carpets. Tana which is streached wise in the Warp beam and another is Bana. This bana is used wirthwise. This tana which is also knows as warp is generally in white colour wheareas Bana is used in coloured depending upon the design of the Carpets.

The Bana is interlaced with Tana by the means of hand or shuttle. Richness of the Carpets depends upon the number of Knots in the Carpet and type of designs.

aw materials needed in the Carpet are l, Cotton Yarn and colours which are able in local market. In most cases artisans does not facing any difficulty tting the raw-material.

ess of Manufcturing :

Dying of wool.
Prepration of Wollen balls.
String and tide Vertically on looms.
Passing of wollen thread horizontally.
Each knot is tightend with the help of Panja.
Levellings is done with the help of Scissors by cutting the threads.

hing

Estimation

1. *Non Recuiring Expenditure*

No.	Name of the M/cs	Qty.	Rate	Cost.
	Loom Size 14 Ft	4 Nos	700/-	2800.00
	Loom size 6 Ft.	16 Nos	300/-	4800 00
	Char	20 Nos	15/-	300.00
	Ankuri	20 Nos	10/-	200.00
	Gandla	20 Nos	10/-	200 00
	Balli	20 Nos	5/-	100.00
	Bambor	20 Nos	5/-	100.00
	Patri	52 Nos	10/-	520.00
	Tub for Dyeing	1 No	200/-	200.00
	Bucket	4 No	40/-	160 00
	Bhatti	1 No	100/-	100 00
	Punja	52 Nos	20/-	1040.00
	Scissors	52Nos	15//	780.00
	Chura	52 Nos	5/.	260.00
	20 Tube Lights, Fans etc			2000.00
	Electrification Charges			2000.00
	Office furniture			8050.00
				23610 00
			Sales Tax	1200.00
				24810.00
	Say 250 0.00			

Recurring Expenditure

prox. Space requirment for ustrial steel 4000 Sq Ft.
nt for Industrial shed. Rs. 2250 App.

1. Raw-material (per month)

(a)	Wool (10.11s)204 Kilo Rs. 45/Ks	Rs.	9190.00
(b)	Soot 34s Doz @ Rs. 45/-	Rs.	1530.00
(c)	Chemical, Dye fan washing and dyeing	Rs.	600.00
(d)	Coal	Rs.	250.00
		Rs	11570.00

(3) Salaries of the Staff and Labours :-

Indirect Labour

S.N.	Designation	No.	Salaries
1.	Manager	1.	Rs. 1000.00
2.	Purchase cum sales man.	1.	Rs. 500.00
3.	Supervisor.	1.	Rs. 600.00
4.	Peon cum Chokidar	1.	Rs. 200.00
5.	Accountant Cum typist (Part Time)	1.	Rs. 200.00
			Rs. 2500.00

Direct Labour

1.	Dyer	One	Rs.	500.00
2.	Blacher	One	Rs.	500.00
3.	Helper	Two	Rs.	400.00
4.	Labour per putting Wool 20s balls.	6/-per day	Rs.	3000 00
5.	Weavers (Rs 17.50 per sq. feets)	53	Rs.	11000.00
6.	Designer	one	Rs.	150.00
			Rs.	15,500.00

Total = Direct + Indrect Labours (15,5000 + 2500) = 1[illegible]00

4. **Misc. Expenditure**

(a)	Water and power charges	Rs.	100.00
(b)	Advertisment	Rs.	100.00
(c)	Travelling Conveyance	Rs.	500.[illegible]

(d) Packing charges	Rs. 200.00
(e) Stationery charges	Rs. 100.00
(f) Welfare of the staff	Rs. 300.00
	Rs. 1300.00

5 Production per month

The production per month of 4′ × 6′ Carpet will be 16 Ms and 9′ × 12′ is 4 Ms per month.

Recuring expenditure of one month

1. Rent	2250.00
Raw material	11570.00
3. Salaries of the staff.	18055.00
4. Misc. Expenditure.	1300.00
	43,175.00

Working Capital for 3 months

43,175 × 3 = 129525

Say 130,000

Total Instalm nts

Fixed Capital	25,000.00
Working Capital	130,000.00
Total	1,55,000.00

Cost product on per month

1. Raw-material	11,570.00
2. Salaries	18,055.00
3. Misc. expenditure	1300.00
4. Interest on capital	1500.00
in weight	210.00
5. Deperation on M/c	210.00
@10% P.A.	210.00
	Rs. 32,635.00

Profitability

Sale value of 16 Carpets @Rs. 1200/- of size 6′ × 4′ and 4000S of Carpet @ 5400/- of size 9′ × 12′.

Selling Price	= 40800.00
Expenditure	= 32635.00
Grand Profit	= 4800.00
Percentage of Profit	12½ -

OK REVIEW

:utta is, Samaddar Siva Prasad

Vhite art paper, Hard board cover, illus, <6", pp 324, illus coverlet. Publishers the poration of Calcutta, 5, S. N. Banerjee d, Calcutta-700 013. Price Rs. 40/- .00 or £ 500).

A Wonderful Book of .what Calcutta Is ay, a panoramic view of struggling, ndering Calcutta, of a strife ridden, blem ridden, trade Union ridden Calcutta, a Calcutta that is both industrial and ural, a centre of quiet learning and yet reat political and economic activities, cutta of sludge and mud and dirt, a cutta in the making towards immense spects of the future, a Calcutta of dream, alcutta that is one ot the important hubs Vorld activity, a Calcutta that attracts attention of the world. The book is a ection of speeches by the author and thoughts and writings by him, supported ample statistical figures. Being Adminis-tor of the Corporation of Calcutta, and h ample administrative and engineering ckground, he is eminently suitable to al with such a complex and vast subject. : with he has dealt with very efficiently fluent, sober and at times humourous guage, interspersed with collections of icatures and drawings.

The subiects he touches are varied from hose Calcutta Managing the Civic Services, lcutta 's Problems and Prospects, City rporation taken up for efficiency against many pressures, Water to shipping, arkets and Hawkers, Spare the Road mpaign or spoil the City, Garbage and what the City can Recycle, Water manage-ment, Sewers and Drains, Civic Services and Finance, Book loving Calcutta and Library movement, Municipal Calcutta—the Legal Frame, Housing, Hawkers and Meena Bazar when advertising a Street Furniture-Kiosks and City problems, Municipal Gazette, Home is Home for fame, City Markets and New Markets, City buildings, tall buildings and building Rules, Haldia Port and Calcutta, Calcutta and its Dream, Tollygunj and its shaping, Calcutta is Calcutta, Calcutta in Eighties Count down for Calcutta 2000, Comparison with Delhi, Cities and City Halls abroad, and finally 'Quo Vadia' Calcutta, Which Calcutta your choice, sober, serious, humorous and catchy, and last what the corporation the author dream.

It is a wonderful book learnedly and informatively written on this problem-plague -ridden Calcutta, with immense dexterity, seriousness, and humour. Yet it must be admitted a few things are missing which otherwise would make the book broadly complete. Calcutta was not built in a day, as Rome was not, or New York was not, or London and Tokyo were not. Without going into '**Calcutta was**', more could have been said about the men who were in the making of '**Calcutta 'is**', apart from the four stalwarts. Suren Banerjee Deshbandhu Das Netaji Subhas Bose, and Dr. Bidhan Roy of recent times. What about the prominent European Chairmen of previous years, sleepily winking out of the pages of the Corporation archives, the first Indian Chairman of Corporation of Calcutta Suren-dra Nath Mullick* of the twenties, whose active hand in catching the culprit in the Coal Scandal of the Corporation hit like a drama the head lines of the City paper

at the times ? A chapter on the names of the prominent Chairmen and Mayors of Calcutta, of the prominent Administrators, Chief Health Officers, City Architects and Chief Engineers who day in and day out served Calcutta with diligence and foresight to make what 'Calcutta is', could have found a particular place for record.

Some more prominence could have been given to the impact 'Calcutta is' by the streams of refugees flowing into the great City over the last 30 years, how the City has tackled the problem, how they are now rehabilitated, what impact they made physically, economically, and culturally on traditioanal Calcutta, how the imported culture of East Bengal has merged in the vortex of Calcutta's culture.

The City has honoured with statues and edifices many of the illustrious sons and daughters of India, whose birthplace and lifelong work place were in Calcutta, and who contributed profusely to 'Calcutta is'. A chapter could have been devoted to this purpose, so that the World could know that Calcutta had a Ram mohon Ray, A Kesub Sen, Shri Ram Krisnha, Vivekananda, Brahmananda, a dramatist Girish Ghose, a Michael, a Bankim, a poet philosopher Rabindra Nath Tagore, artists like Nandalal Bose Abanindra Nath Tagore, a sculpture like Ramkinkar, that Calcutta has given a Maharshi Bhavan.

A separate chapter could have been devoted to these aspects of art, literature and philosophy, and on Tagore, and on that unusual savant on literature, Iswar Chandra, whose head was cut down twice, but surprisingly got back immidiately to its seat to declare that culture and learning are immortal, and that Calcutta's literary eminence in the world cannot be unseated. A chapter could also have been devoted to that giant Institution Calcutta University, its influence on 'Calcutta Is', the men behind it, Sir Asutosh, the Bengal Tiger and others who built it up for 'Calcutta Is' also on the influence of Hindu College (now Presidency College), Hindu and Hare Schools, Sanskrit College, Jadavpur University and other Institutions with legends, the Science College Sir J.C. Bose Institute, philosophical Institutions like Ram Krishna Institute of Culture of international fame, and others that make Calcutta a second seat of Vedanta Culture next to Benares.

'Calcuta Is' is a Calcutta of philanthropic activities. May be the giants like Tarak Nath Palit are not now, but others, Sevasrams, taken up their place and munificence from others is still not lacking.

'Calcutta Is' is seeing many changes of of names of streets daily, names having long historical associations. It would have been worth while to discus further what benefit 'Calcutta Is' is getting in such change when the City cannot associate new names with newer developments,

A chapter could have been devoted to interest of World Bank and Uuited Nations in Calcutta, their loans for benefit of Calcutta's millions. Attention could have been drawn as to how the slums affect the city, how their development affect the City's re-development areas, how the basic concept of matropolitan planing is growing, how

satellite townships are growing around, radial roads, the transverse circular .ds and railways, the solutiou of 'Calcutta 'or transportation and daily commutation, Fire Brigade, how the city boulevards trees are growing, or the greenery is ng preserved, and parks are expanding, v the roads and footpaths in residential as are developing and tree lined how series and schools are growing, education, getting easier to obtain at less harassment, w its quality is improving, how hospital spitalisation benefits are improving, how City's river side Ghats with historical ociations are being preserved and impro-l, how trade and commerce, and airway nnections and 'Green ports' are improving.

The centre throbbing with life and vitality it 'Calcutta Is', is a city of 'tears, sweat, il, money and pleasure'. Yet it is Brahmin learning, Kshtriya in its heroic activities d engineering, Vaishya in its trade, mmerce and technology, and Sudra in its arming labour population, unemployment d trade unionism.

'Calcutta Is' has trampled on the historic own Hall, the hall associated with honour-g many historic people including Tagore d others. It is now a court for City agistrates dealing in petty cases. Its ajesty is gone. Inspite of Mahajati Sadan, alcutta Is' cries for a Town Hall, on the same site, a newer Town Hall, a better Town Hall, that may be called 'Golden Town Hall of the City of Calcutta', to honour men in future, men amongst others whom the City, has thrown up in the past like Tagore, Raman, Jagadish Bose, and whom the city will continue to throw up in future like gold, diamond, pearls rubies and sapphires in the various walks of life, leaving a replica of the 'Old Town Hall' in a glass case Calcutta's grave yards with Michael and De Rozario in their bosoms, the Burning ghats bearing the ashes of the many illustrious sons of the soil also claim a page. A chapter on tourism and Calcutta Is, also has a claim like wise.

Indeed, Calcutta is a voluminous thing. The author has put his hand in a hornet's nest, as each sector of life, each page associatedwith Calcutta Is, and India's history claim a page in 'Calcutta Is'. The author has already performed a Herculean task in his present publication. Standing like Hercules at the prow of his ship of life, against battering storm of administrative sea, and engulfing engagements, like Hercules he has overcome the serpant of maladministration, and also like him overewed the three damsels of inefficiency, corruption, and no work, and so it may be hoped in a next edition, he will pluck and give the readers the complete Golden apples of Hercules through a further Herculean effort.

U. P. MULLICK

NOTES & NEWS:

Recent Developments in Building Materials And Technologies'

A get-together on 'Recent Developments in Building Materials and Techniques' was organised at Lucknow by the Central Building Research Institute, Roorkee, in collaboration with the U. P. P.W.D. and the Institution of Engineers (India) U. P. State Centre, Lucknow. The get-together was arranged to acquaint the Engineers, Architects, Builders, Material manufacturers, and Entrepreneurs and others with some new building materials and construetion techniques of CBRI which could be helpful in solving the acute shortage of scarce building materials in reducing the cost and time of constructions.

The following three technical lectures were delivered on this occasion :

(i) 'Economic Foundations of Buildings' by Prof. Dinesh Mohan, Director, CBRI, Roorkee.

(ii) 'New Building Materials for Uttar Pradesh' by Dr. Mohan Rai, Head, Building Materials Division, CBRI, Roorkee.

(iii) 'Cost-Reducing Design and Construction Techniques' by Sri R. C. Mangal, Dy. Director, CBRI, Roorkee.

During his lecture, Prof. Dinesh Mohan highlighted various ways and means for effecting economy in the design and construction of foundations. He pointed out that simple corelation between allowable soil pressure and static cone resistance prove extremely useful for foundations on sand. Similarly for loose sandy deposits below water table, borod compaction piles developed by the Institute, prove to be about 35 percent cheaper than the conventional footings. In certain situation multi-under-reamed piles prove much more economical than the conventional large diameter borod piles.

Delivering his talk on 'Cost Reducing Design and Construction Techniques', Sri R. C. Mangal, highlighted several techniques of the Institute viz. stone masonry blocks for walling, channel units, cored units, R. C. Planks, prefabricated brick panels, waffle units etc. for flooring/roofing which could be easily adopted for building better, faster and economic houses.

Each lecture was followed by lively technical discussion on various points covered in the talks. A 3 day Exhibition on Building Materials and Techniques, developed at CBRI, was also arranged on this occasion.

The get-together as well as the Exhibition were inaugurated by the U.P. P.W.D Minister Sri Mohammad Masood Khan.

More Australian Solar Energy Projects Under Way

Scientists technicians are working on 143 solar energy projects throughout Australia. Most activity is in the area of collector technology, and considerable emphasis is being given to research into heating and cooling of building. Solar collector research is directed towards finding more efficient ways to collect, store and harness solar radiation.

n Artificial Hand with a Sense of Touch

An artificial hand with its own sense of uch developed at the University of Queensnd is ready for production. The inventor is r. Gerald F. Shannon, a senior Lecturer in ectrical engineering at the University of ueensland, Brisbane. The hand, covered ith lifelike plastic skin, harnesses the ody's natural electrical signals to provide ntrol, strong grip and-most remarkably-a nse of feel. The device in compact, weighs out the same as an average adult for earm s no straps or harness, and can be slipped n or off the stump in a few seconds. Cost this hand will be about $A 2000.

ause of Tornadoes :

Dr. Roger Smith of Monash University, elbourne and Dr. Lance Leslie of the ustralian Commonwealth Scientific and dustry Research Organisation have made mathematical model which simulates the rth and growth of tornadoes in strom ouds. The mathematicians say the rapidly-ising column of air draws in more air from e cloud around it. This air, instead of eing drawn straight in and upwards, curls ound the main updraught with increasing eed in a tightening radius, like a weighted ring winding around a pole. At a certain age, the vortex thus formed ceases to ntract, balanced by the outward-thrusting rce of its spin. When the upper part of e vortex reaches this stable state, the lower d of the funnel continues to draw air to-ards and into it, provided there is already me rotation of air in this region. In this ay, the funnel gradually extends down to-ards the ground until the classic destruc-ve ' twister" extends from cloud to ground.

Light Duty Closed Track Overhead Conveyor System :

Stewart Gill & Co. Ltd. have introduced a new overhead conveyor system for light duty applications, throughout industry. The new conveyor is of closed track type and offers a maximum capacity of 30 kg. per load link, and a safe working chain pull of 200 kgs. It is fully bi-planar. The conveyor is of bolted construction, simplifies installation and makes the system ideal for customers who wish to use their own engineering staff to install the equipment. Further information literature, etc. on this 200 L can be obtained direct from Stewart Gill & Co. Ltd., 163, Bath Road, Slough, SLI 4AB, United Kingdom.

Protecting the Taj Mahal :

Expert Committee noted that significant pollution levels already exist in the Agra region and recommended that efforts should be made immediately to minimise the existing pollution from sources close to the monument in Agra Zone. A significant reduction in the existing levels of sulphur dioxide and particulate matter at Agra is possible by closing down the power plants near Agra Fort and Itmat-Ud-Daulah. Secondly Railway may be advised to replace the present coal-based Locomotives with diesel-based locomotives at the marshalling yard which is very close to the Agra Fort. Steps may be taken to ensure that no new large industries such as Fertilisers & Petrochemicals or small industries be established in Agra region and its neighbourhood. Committee further recommends that an appropriate authority be created which could

monitor emissions by industries as well as the air quality at Agra on a continuous basis. This authority should be vestedwtih powers to direct industries causing pollution to limit the level of emission and specify such measures as are necessary to reduce the emission whenever pollutant level at monuments exceeds acceptable limits.

Forth coming Events :

Electrochemical Research & Industry Get-Together, September 1978

The Central Electrochemical Research Institute, Karai Kudi, Tamil Nadu :

Central Electrochemical Research Institute, Karaikudi, Tamil Nadu will celebrate the Silver Jubilee throughout this year. As a part of this celebration C.E.R.I. will organise a Research & Industry Get-together at the institute from September 18 to 21, 1978. There will be seven technical Session covering the following areas.

1. Industrial electrolyfic cells for production of organic and inorganic products.
2. Electrometallwigg and electrothermal products.
3. Electrodeposition and metal finishing.
4. Corrosion and its prevention.
5. Power Sources.
6. Solid state electrochemistry.
7. Promotion of Small Scale and Cottage industries in rural areas.

For each session, a key paper will be presented by a senior scientist of this Institute. The paper will highlight the capabilities the results achieved and future programme of work of the Institute in the particular area. *Representatives from industry will* also be invited to present key papers indicating the present trend of the concerned industry and the problems faced by them Discussions will follow immediately after presentation of each key paper.

Members interested to represent our Society in this Get-together may contact our General Secretary.

OUR READERS WRITE

PUBLICATIONS & INFORMATION DIRECTORATE (CSIR)
TECHNICAL INFORMATION DIVISION
Hillside Road, New Delhi - 110012

No. Pub-9-R/78 Dated 7-7-'78

We would greatly appreciate to have reprint of your articles : Tea Industry in India and Tea for everybody. Sci. & Engng. 31(4), 53-56, 1978.

We are sure, it will be of much interest to our editorial staff working on 'The Wealth of India'.

Yours faithfully,
Sd/- Illigible
Scientist-in-Charge

PUBLICATION RECEIVED

1. Union Ministry of Agriculture & Irrigation, New Delhi—Annual Report 1977-1978.
2. Union Ministry of Petroleum, Chemicals & Fertilizers, New Delhi—Annual Report 1977-1978.
3. Union Ministry of Labour & Employment, New Delhi—Annual Report 1977-1978.
4. Railway Board, Ministry of Railway. 1 New Delhi—Annual Report & Accounts 1976-1977.
5. Union Ministry of Transport & Shippings. New Delhi—Annual Report 1977-1978.
6. Union Ministry of Home Affairs, New Delhi—Annual Report 1977-1978.
7. Union Ministry of Industry New Delhi—Annual Report 1977-1978.
8. National Chemical Laboratory, Poona—Annnal Report 1976-1977.
9. Central Building Research Institute. Roorke—Annual Report 1976
10. National Environmental Engineering Research Institute. Bhavnagar—Annual Report 1976
11. Geological Society of South Africa Johannesburg—Transactions—August 1977.
12. Indian Agricultural Research Institute, New Delhi—Annual Report 1975.
13. Central Water & Power Research Station Poona—Annual Research Memoirs 1975.
14. Central Water & Power Research Station Poona—Annual Research Memoir 1976.

OUR AUTHORS

A. Haldar

Shri Anupam Haldar, immediately after graduation during 1968 in Mechanical Engineering Stream from Bengal Engineering College, Shibpur, of the University of Calcutta, took up Air Movements & Pollution Control as his professional field of interest. Having served two other leading companies in the field of Air/Gas Handling, Shri Haldar presently looks after 'Aero-Engineering & Pollution Control Division' of Messrs Hindusthan Development Corporation Ltd., Calcutta. He takes active interest in the promotion of Environmental Pollution Control Measures and is presently connected with Indian Association for Air Pollution Control, Varanasi, as the Area Convener : Calcutta Chapter. Besides professional attainments, he is having to his credit, a few published papers on the allied subjects of Industrial Ventilation & Pollution Control.

H. C. Chatterjee

After passing Electrical Craftsmanship examination of Govt. of India Started his career as Electrician. Later he left for Germany Passed the Electrical Control Engineering and became VDE in 1966. Served Osram Gesellschaft mit beschrankter Haftung Werk S and a number of firms in Germany, Canada & U.S.A. He is now associated with Vinokur-Pace-Engineering. Services Inc. Philedelplia U.S.A. where he is the Chief Electrical Engineer. He has to his credit a number of technical publications. For his distinguish ontribution in Electrical Engineering, Sussex College, England awarded him HonoraryPh.D. degree in electrical engineering in 1974. He is a Member of a number of lerned bodies in India and abroad. He is a Member of the India Society of Engineers and honorary corresponding member of this Society in U.S A.

T. G. Krishna Murthy

Graduated form Mysore University (1951), completed post-graduate electronics course at Madras Institute of Technology (1955), Research Fellow in Biophysics, National Institute of Mental Health and Neurosciences (1958-1961) ; part time 'tutor St. John's Medical College (1964-1968) ; Hon. Adviser and Consultant to industry, medical institutions etc., Member, ICMR Panel on BME Medeless Panel, Electronics Commission, Advisory Committee of Advanced .Training Institute on Process instrumentation and Electronics, Hyderabad ; has over 200 publications to credit in the field .covering varied aspects like safety, development, manufacture, maintenance, marketing, techniques ; on invitation attended seminars and symposia in India and abroad ; member of several professional organisations in the field. Hon. guest editor, issues on BME.

R. Coomar

Shri Rakesh Coomar passed the National Diploma in Textile Engineering in 1968. Later on he was awarded L.T.I. of Manchester England. He is also a member of Textile Association (India). He is now with Delhi small Industries Development Corporation and is responsible for production, Inspection, Quality Control of Engineering products produced by Small Scale Industries. He has already published paper on Textile Industries. He is an Associate Member of India Society of Engineers.

An Appeal

BACK ISSUE WANTED

CIENCE & ENGINEERING, 1956 and 1957 Volumes, are missing rom our files. Not even a single Copy of any issue of these Volumes s traceable at our end. Readers and Subscribers are requested to let is know if the said Volumes, in whole or in part, are available with hem. If so we are prepared to bear all cost for their reproduction in nicrofilms or by Zerox Copies. Their kind Co-operation with us in naking our files for the past volumes of our Journal will be deeply ippreaciated.

Editor
Science & Engineering

SOME HIGHLIGHTS ABOUT I S E

- Incorporated on August 6, 1934, it is in existence for 44 years.
- Its membership is open to Engineers and Industrialists and Technologists, Technicians and Learners alike.
- It now offers membership to respectively qualified persons in seven categories: Fellowship (F.I.S.E.), Membership (M.I.S.E.), Associate Membership (A.M.I.S.E.), Licentiateship (L.I.S.E.), Associateship (Assoc. I.S.E.), Graduateship (Grad. I.S.E.) and Studentship (Stud. I.S.E.).
- It has on rolls nearly 5000 members within the country and all over the Globe including Bangla Desh, Burma, Ceylon, Singapore. Malayasia, Middle East and African countries the U.K., U.S.A. and West Germany.
- It publishes a Monthly Journal, "SCIENCE & ENGINEERING", from 1935, commanding a circulation throughout the world.
- It maintains a Library containing above 2,000 volumes of Books and Reports.
- It has published some technical text books by noted Member-Authors, e.g. "Building Materials", & "Mineralogy, Petrology & Economic Geology" : Tables (an enlarged Third Edition of this latter work i. e. the TABLES has been recently published by the Indian School of Mines & Applied Geology, Dhanbad.)
- It conducted Postal Coaching for sometime, also a Refresher Course for Electrical Supervisor's Certificate examinees.
- Its ambassadorial services embrace Lecture Programmes, Inter-Society collaboration and exchange of ideas, delegation to national and world Engineering Congress.
- It of late has urged and brought to the notice of the Government the need for National Engineering & Technology Policy.
- It acts as a principal sponsor of the Federation of Professional Engineering Institutions of India (F.P.E.I.I.) cum the Joint Indian Engineering Council (J.I.E.C.).
- It of late has set up a BRAIN TRUST along with Technical Information Department to provide aid and guide to Operational Research and Practice in different fields of Engineering and Technology.
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SCIENCE & ENGINEERING

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SCIENCE OF LAWS OF NATURE

In the words of Dr. K. R. Chakravarty "Search for a fundamental law which overns the phenomenal manifestations in the Universe, its creation, dissolution and its quilibrium existence, has been the subject matter for searching mind from time mmemorial". Probably the earliest theoretical attempt at probing the laws of Nature vas in the Indian Sankhya Philosophy in ancient India on the law of numbers. It is rom this that later science, philosophy, mathematics and astronomy developed. The evolution of digits, the concept of continuum of numbers, the zero, one and infinity vere the first wonderful discoveries that came out in that integrated concept. In the West, he process started later through Aristotle, and progressively advanced rapidly over the centuries through Galileo, Newton, Plank. Bohr, Becquerel Copernicus, Coloumb and others, then to Einstein culminating in his Special Theory in 1905 The search has continued since then through Rutherford, Thompson, Hess, Geiger and Miiller, Van der Graff, Cockroft and Walton, Urey, Soddy, Brickwedde, Murphy Hisenberg, Bethe, Chadwick, Anderson, Lawrence Curies, Neddermeyer, Rabbi, De Brogli, Hahu, Openheimer Stevenson, Strassman, Kerst, Fermi, Bose Packard Shroedinger, Schmidt, Vecksler, Mac -Millan, Rosenblum, Bhaba and others.

Through the basic poslutates of Einstein's Special Theory several scientific phenomena which were unexplained before found satisfactory explanation. Doubts however were raised about the constant maximum veloicty of light in vacuum. As Chakravarty has argued, if it is assumed that in vacuum which would particularly mean space containing nothing, velocity of propogation of light would be maximum such constancy of maximum velocity of light cannot be reached in universal media, since in the phenomenal universe different media of different phases exist through which light propagation occurs. In the manifest Universe there is no space which contains nothing. Therefore assumption of constancy of maximum velocity of light in Vacuum (meaning nothingness) and computation of the same value as 186,000 miles per second in media consisting of different phases which have been already manifested seem somewhat confusing. On top of this, there is the question of influence of Universe Gravitational force on light travelling at any place, which has also so far not been investigated or spelled out properly, or related properly with Einsteins' Special Theory.

Einstein's Special Theory of relativity employs Lorenz transformation in one particular direction of increase of velocity of the body with respect to the observer in direction away from the observer. On this Chakravarty has pointed out that space contraction and time dilation are the only changes possible according to this approach but if the direction of increase of velocity of the object from a distant position towards the observer were considered as the opposite case, then would Lorenz transformation still be valid and would lead to same space contraction and time delation.[2]

Dingle published several valuable papers on this aspect showing that moving clock can go fast also. Dingle dealt with Three such cases in which the problem posed by him were parallal to Einstein's. His observations were published in Nature. Einstein's theory postulated that in such case space will contract and time will dilate, and the clock will only go slow with increase in velocity - Dingle has shown in his papers (case 1. Nature Sept. 8.1962, case 2. Nature March 30, 1963 and case 3 Nature Oct. 14, 1967) that with same stipulations of Einstein's, opposite phenomenon can also occur, that is time can contract and space can dilate and the clock can go fast. He showed that time marked by the clock (viewed from the stationary system) is slow by $1-\sqrt{(1-v^2/c^2)}$ per second per second, or neglecting magnitudes of four and higher order, is slow by $\frac{1}{2}v^2/c^2$ second per second.

The kind of state of phenomenal nature leads us to a surprising concept. In one concept there is a state of oneness of nature and in the other state there is nothing. Both are abstract states in which one may contain only one and the other in combination may contain absolutely nothing Dr. Chakravarty calls this state a wholly critical state.

Now the surprise comes when we replace these two states by saying that in one case all the energy of the universe is concentrated into oneness at the source, and in the other case all the gravitational force of the universe in combination passes through the centre of the spherical continuum shell. A combination of these two states is a critical state. Where total energy of the universe is matched in combination with the total gravitational force of the universe, existence of such state is momentary, that is the duration of the critical state is infinitely small. In such a state of the phenomenal Universe, the state is unreal and unstable, and would be the cause for adjustment of change, or action toward a state, a Kinetic state from potential, through a state of movement and velocity towards a state of stable equilibrium or entropy stage with all the energy and mass moving towards the spherical space boundary.

This dictates, both in terms of Science and philosophy, that in the concept of Universal nature, anything by alone, that is concentration of all the energy of the universe at pin point source by alone in existence must lead to manifestation by involving or associating some other thing, namely matter, thus giving rise to the phenomenal existence and variegation of Nature.

Obviously there are two phases in equilibrium combination in finite Nature. They coexist in such a manner that the properties of one phase are exactly opposite of the other phase, just a reverse phase. In one phase it is space bearing or vapour like dispersing, in the other phase it is segregating or condensing to dense matter. In one phase it is radiating out from pin point source, in the other it is converging to the pin point source of position, In one phase the distributed positions have tendency for repulsion and in the other phase tendency is towards attraction or gravitation. In one phase the constituents are in such a state of motions that they .become infinitesimals and one with space, and in the other they are in a state which is distinct from space, distinguishable with point of position and with distinct configuration. In one phase there is increase in intensity and velocity, in the other there is decrease in intensity and velocity with coresponding rise and fall of temperature. This is just like where vapoured density increases, liquid density decreases, with rise of temperature, till a critical temperature state where liquid phase vanishes and only vapour phase dominates with maximum density and intensity.

Thus the unit of evolutionary concept is an unit of movement and rest, an unit of oscillation from movement to rest in which the first critical state is a state of oneness of derived aspect and the intermediate critical state is a state of inequality of the two, debalancing of Radiation force and gravitational force, and the third critical state is a state of entropy. As both the first and third states are unstable, there is a continuous oscillatory movement of matter and energy and expansion and contraction of space and dilation and contraction of time, and rise and fall of temperature.

The Law governing development of the evolution waves in terms of square space units is given by the general formula $a^2 = (1 + 4m + 4m^2) = (1 + 2m)^2$ in which a^2 represents whole squares of space, and m or matter is associated will the squares of space continuum,

Methematical Models of Ecological Systems

By

Dr. T. K. DAS*

Seientists are realising more and more that not only physical laws but also Biological and Ecological systems must be studied quantitavely. This article attempts to emphasize the importance of mathematical models for Ecological systems. A few simple mathematical models of .Ecological systems have been described as illustration.

Introduction :

A satisfactory comprehension of Nature is generally believed to be achieved if a coherent mathematical (i.e., quantitative) cause and effect relationship can be formulated for the system under consideration. This has been the ultimate goal in physical science for nearly a millennium. However Life-Science and environmental studies (now generally called Ecology) had been treated on a very different footing, until only recently. The study of these science upto the last century seems to be content with only qualitative, semi - descriptive understanding and attempt has seldom been made for a quantitative understanding, starting from first principle. Only after the first quarter of this century, by which time physical sciences had sprung to astounding mathematical sophistication and detailed understanding, people began to attempt quantitative understanding of life-sciences. This belated mathematical approach is understandable, if one realises how complex and intricate the Biological systems are. Although the physical laws of Nature must ultimately be obeyed in the biological systems as well the immense complexity and an essentially statistical nature of the latter makes it nearly impossible to comprehend everything quantitatively starting from the first principles. The famous particle physicist R. P. Feynman contends that the physical laws must ultimately be very simple. However no one, uptill now, has courage to make a similar statement about biological and Ecological systems under these constraints, the study of the Biological systems must necessarily be confined to the investigation of simplified mathematical " Models ". By "model" we mean description of the system in terms of mathematical equations. These equations are arrived at through simplifying assumptions and mathematical idealization. The validity of a model is judged by now how closely it reproduces observed facts. A lot has been achieved in terms of these models. There has been an explosive increase in the number and the sophistication of such investigations over the last couple

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This paper was received in June 1978.

ıdes. In general these models involve hematical equations which are very com- ıted and more often than not, a rigorous ytical solution cannot be found. The : approach is to look for mathematical roximations which are reasonable or to to a sophisticated computer for a nume- l solution.

ka-Volterra Model-Prey-Predator System

The first model we consider is of much ctical and business interest. The model proposed by Lotka (1923)[1] and Volterra 28)[2,3] to explain the periodic variation in population of two types of fishes, one e and the other small, in a lake. It was eved that the small fish (Prey) lives on ae, which was plenty in the lake, but the ge fish (Predator) lives solely by eating the ıller variety. As a result when the popu- on of the large fish is large, they eat the aller fish rapidly and the latter population he latter falls. After a while the number the large fish begins to fall, for want of d (i.e., prey). Again after a while as the nber of large fish falls, the number of all fish begins to rise, this time happily spering due to a relatively smaller num- r of predators. Again after a while, when prey population increases the predator s a plenty supply of food (prey) and thus eir number begins to rise again. This cycle eps repeating over and over. A mathe- tical analysis of this phenomenon would very helpful to fishermen who are intere- d in the large variety. Latka and Volterra posed the following equations to express rates of change in the number of the prey N_1) and the number of predators (N_2) :

$$dN_1/dt = \alpha N_1 - \beta N_1 N_2 \quad \ldots \ldots \ldots (1)$$

$$dN_2/dt = -\gamma N_2 + \delta N_1 N_2 \quad \ldots \ldots (2)$$

If there were no predators ($N_2 = 0$), then eq (i) says that the rate of increase of fhe prey population is proportional to the actual number of preys (N_1) at that instant. α is called the free growth rate of the prey. This shows that, in the absence of predators, the population of the prey will increase exponentially with time :

$$N_1(t) = N_1(o)\, e^{\alpha t}, \quad (\text{if } N_2 = o) \ldots \ldots \ldots (3)$$

This is the famous Malthusian equation of population growth, assuming an infinite supply of food and a non-hostile environment. Similary if there were no preys (i.e., $N_1 = O$), eq (2) says that the number of predators would decrease exponentially with time :

$$N_2(t) = N_2(o)\, e^{-\gamma t} \quad (\text{if } N_1 = O) \ldots \ldots \ldots (4)$$

Since the predator lives solely on the prey and there is no prey ($N_1 = O$), the number of predators must decrease for want of food, which is related in eq (4), γ is called the free decay rate of the predators. Due to the presence of both prey and predator the second terms called "interaction terms" appears on the right side of both eqs (1) and (2). β and δ are the interaction co-efficients and $\beta N_1 N_2$ is the rate of binary encounters of prey and predator per unit time, It is assumed that in each binary encounter a prey is eaten up by a predator ; therefore the prey population decreases by $\beta N_1 N_2$ per unit time and due to the increased supply of food (prey) predators multiply easily and their number increases, the rate of such increase is $\delta N_1 N_2$ appearing in eq (2).

It is possible to eliminate 't' between eqs. (1) and (2) and find a closed analytical relation between N_1 and N_2, by dividing eq (1) by eq (2)

$$dN_1 / dN_2 = N_1 (\alpha - \beta N_2) / N_2 (-\gamma + \delta N_1) \quad 5$$

Equation (5) can be written as

$$[(-\gamma/N_1) + \delta] \, dN_1 = [(\alpha/N_2) - \beta] \, dN_2$$

and integrated immediately to obtain

$$A N_1^{\gamma} N_2^{\alpha} = e^{\delta N_1 + \beta N_2} \quad \ldots \ldots - \quad (6)$$

where A is an integration constant. Equation (6) can also be written as

$$e^{\beta N_2} N_2^{-\alpha} = A N_1^{\gamma} e^{-\delta N_1} \quad \ldots \ldots \ldots (7)$$

Equation (7) gives a rather complicated transcendental relation between $N_1(t)$ and $N_2(t)$, where time (t) appears as a parameter. However neither N_1 nor N_2 can be expressed in terms of the other through an analytic relation. $N_1 - N_2$ curve would be a closed curve, which reproduces the observed fact that both $N_1(t)$ and $N_2(t)$ oscillate with a phase lag between them.

One can try to eliminate either N_1 or N_2 between eqs. (1) and (2) and express the other in a differential equation involving time. For example by eliminating N_2 between eqs. (1) and (2) have,

$$(d^2 N_1/dt^2) - \alpha N_1 (\gamma - \delta N_1) + (dN_1/dt)(\gamma - \delta N_1) - (1/N_1)(dN_1/dt)^2 = 0 \quad (8$$

This equation unfortunately, is a second) order non-linear differential equation and there are no analytical method to solve this equation. A similar equation can be obtained for N_2. To solve eq. (8) approximations have been employed [5,6]. Alternatively one can solve eq. (8) numerically using a computer.

A Mathematical Model For Epidemics :

Serious epidemics like plague, cholera etc. are curses to mankind and a serious health problem to the local authority. There are less serious epidemics, as well as epidemics of the animal and vegetable world. Hence mathematical analysis of the epidemics is of immense importance to mankind. The first attempt was by Kermack and Mckendrick in 1927 [7]. They divided the population of a given region into three classes :

(a) Susceptible population, S(t) — Those who are susceptible to contact the disease but as yet not infected.

(b) Infected population, I (t) — Those who have already contacted the disease and capable of transmitting it to others.

(c) Removed Class, R (t) — Those who once contacted the disease and subsequently either died or are cured and thus permanently immune. Hence R — Class is "removed" from active population

Due to each contact between a susceptible individual and an infected individual, the former contacts the disease and thus is transferred from the S - class to the I - class. Thus the rate of this binary encounter is proportional to both S (t) and I (t) and the proportionality constant is assumed to b α per unit time. The removal rate from I-class to R-class is proportional to I (t) and the proportionality constant is γ per unit time. Then we may write the equations as

$$dS/dt = -\alpha S I \quad \dots \dots \dots (9)$$

$$dI/dt = \alpha S I - \gamma I \quad \dots \dots (10)$$

$$dR/dt = \gamma I \quad \dots \dots \dots \dots (11)$$

that $(d/dt)(S+I+R) = 0 \quad \dots\dots (12)$

n exact solution of this system of equations an be found[8]. An important feature of this odel is the existence of a threshold value f S.

$$S_{threshold} = \gamma/\alpha \quad \dots \dots (13)$$

'or $S < S_{threshold}$, $(dI/dt) < 0$ [from q. (10)] and so I (t) decreases with time. 'hus the epidemic simply dies away; only $S > S_{threshold}$, the epidemic sustends self.

Model for Spreading Epidemics :

A model has been proposed[9] for the patial spreading of epidemics outwards rom an epicentre. It is assumed that the opulation is uniform and there is no net nass movement of population, but each ndividual can travel a short distance $\triangle r$ rom its normal dwelling place and thus can either receive or transmit the disease by contact. This is the assumed mechanism patial spreading.

We divide the entire populated area under consideration into successive concentiric rings of width $\triangle r$ (Fig 1). An infected individual at the outer edge of R_1 has the ability to travel the entire length of R_2 and thus transmit the disease. On the other hand a susceptible individual of R_1 can also traverse the widths of R_2 or R_3 and receive the disease from an infected individual of the rings R_2 or R_3 respectively. The net effect of all these is that the epidemic spreads itself outwards. We also assume that an individual who just contacted the disease, spends a time T, called "suffering period" in the I-class, before he can be removed to

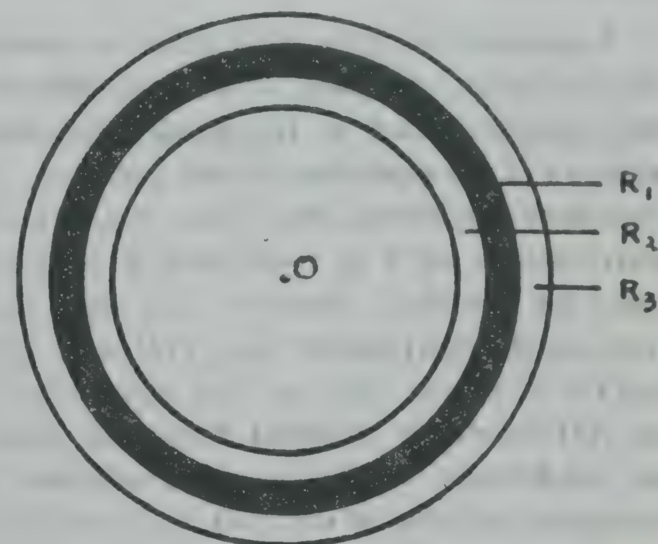

FIG. 1

R-class. Thus the rate of removal $I \to R$ is not proportional to the instantaneous I (t) but to I (t-T). The equations can now be written as

$$\left[dS(r,t) \big/ dt \right] = -\alpha_1 s(r,t) I(r-\triangle r, t) - \alpha_2 S(r,t) I(r,t) - \alpha_3 S(r,t) I(r+\triangle r, t) \quad \dots \dots \dots (14)$$

$$\left[dI(r,t) \big/ dt \right] = \alpha_1 S(r,t) I(r-\triangle r, t) + \alpha_2 S(r,t) I(r,t) + \alpha_3 S(r,t) I(r+\triangle r, t) - \gamma I(r, t-T) \quad \dots \dots \dots (15)$$

$$\left[dR(r,t) \big/ dt \right] = \gamma I(r, t-1) \quad \dots \dots (16)$$

Here, α_1 =forward interaction co-efficient (for interaction form a given ring to the adjecent outer ring)

α_2 =Self interaction co-efficient

α_3 =backward interaction co-efficient (for interaction from a given ring to the adjacent inner ring)

Equations (14), (15), (16) form a system of non linear, coupled, functional differential equations and a rigourous analytical solution of the equations is not possible. A boundary conditions, the initial (i.e. at t=0) distributions of I (r, t=0) and S (r, t=0) must be specified. For $r < \triangle r$ the first term on the right side of eqs. (14) and (15) and for $t<T$, the last on the right side of eq. (15) should be dropped from the physical conditions. Under these conditions, a computer solution of eqs. (14), (15) and (16) were performed[9]. The result shows that the epidemic travels outward from the epicentre like a pluse with a specific velocity of propagation. Superimposed on this travelling pulse, one finds standing pulses at certain positions depending on the parameters. At a given point, the plot of I (r, t) versus time shows that it has a sharp pulse like character. This agrees qualitatively with the observed data of the notorious great London plague of 1665[10]. This shows that the model is successful in describing the spread of epidemics in pulses.

Conclusions :

All these models, as well as many more models of similar nature are based on simplifying mathematical idealizations. Such idealizations are seriously questionable in some cases. In some cases the idealizations make the model quite different from the reality. On the other hand even with the idealizations taken for granted the equations can hardly be solved exactly. One naturally, then, has to make approximations which in turn may be seriously questionable. Then the only possibility remaining is to turn to a modern high speed computer for a numerical solution. Nevertheless the importance of these mathematical investigations cannot be over emphasized.

References :

1. A. Lotka, "Elements of Physical Biology" (Dover Publication, 1924).
2. Volterra, "Lecons sur la Theorie Mathematique de la Lutte pour la vie (Ganthier—Villars, 1931).
3. Volterra, "Pricipes de Biologic Mathematique". Acta Biotheoretica 3, 1 (1937).
4. R. Rosen, "Dynamical system theory in Biology" (Wiley Interscience, 1970) p.43.
5. T. K. Das and U. K. De, "A comment on the analysis of Volterra model" Current Science 46, 515 (1977).
6. U. K. De and T. K. Das, "Perturbative Solutions of the Volterra model" (To be published in Current Science).
7. W. D. Kermack and A. G. Mckendrick, Journal of Royal Statistical Society, Ser A, 115, 700 (1927).
8. N.T.J. Bailey, "The Mathematical Theory of Epidemics" (Griffin Book Co., 1957) p.25.
9. T. K. Das and U. K De, "A model of spreading epidemics", submitted for publication to the Journal of theoretical Biology (1978).
10. Data presented in "Ecology and Resource Management" by K. E. F. Watt (McGraw Hill, 1968) p.159.

Quantum Electrodynamics
AND
Speed Greater Than Light

By

U. P. MULLICK*

ctromagnetic Field of Quantum Energy

Each quantum of energy in motion has own electromagnetic field. When the antum moves, it creates a spin, and eonuently creates its own electromagnetic d. If alone, this field does not interact h neighbouring other fields of other anta of energies. But as soon as it passes ar other quantum particles of energy of ser or higher energy levels, the fields eract, and there is generated gravitational ce, generated between the two quanta. e higher energy quantum having wider avitation a field attracts the quantum rticle of lower level of energy, and of aller field, which tends to gravitate tords it, and there occurs a relativistic duction in speed difference between the o quanta. The points of intersection tween the lines of force of the two fields eate a sack pointing towards the centre of e quantum particle of higher energy level, hich causes the lower energy level quanm to slide towards the higher level antum.

Inversely it can be said that a higher ergy level quantum energy particle passing a lower energy level quantum particle lls up the speed of motion of the lower ergy level quantum, and makes it bend oser to it.

Lecture delivered on August 11 & 15 1978 at the ndia Society of Engineers.

Nature of motion of quantum of energy

Take the simple equation $s=vt$

Where s = distance travelled by a quantum of energy

v = velocity of motion

t = time of travel.

For a given time t, motion equation of a particle of quantum energy is :

$$t=\frac{S_{uv}}{v_{uv}},=\frac{S_v}{v_v}=\frac{S_i}{v_i}=\frac{S_b}{v_b}=\frac{S_g}{v_g}$$
$$=\frac{S_y}{v_y}=\frac{S_o}{v_o}=\frac{S_r}{v_r}=\frac{S_{ir}}{v_{ir}}$$
$$=\frac{S_R\ 1\text{ to }n}{V_R\ 1\text{ to }n}$$

where the space travelled and velocities o. motion are respectively

s_{uv} and v_{uv} are for ultraviolet light,

s_v and v_v for violet light,

s_i and v_i for indigo light,

s_b and v_b for blue light,

s_g and v_g for green light,

s_y and v_y for yellow light,

s_o and v_o for orange light,

s_r and v_r for red light,

s_{ir} and v_{ir} for infra red light,

$s_{R(1\text{ to }n)}$ and $v_{R(1\text{ to }n)}$ for Radio waves, micro, short, medium and long waves.

Now energy is known to travel both as a particleo beying particle dynamics, and as wave obeying wave mechanics,

It is postulated here that quantum energy of any particular wave length travels as a concentrated energy particle with its own electromagnetic field, and moves forward axially along line of motion, but traces in space a spiral motion around the axis of motion, as if it traces its spin path along the surface of a cylinder whose diameter is related to its wave length and to its speed of motion. For an energy particle with greater velocity, its wave length (λ) is smaller, spin rate per unit time is higher, and spin diameter (diameter of tracing cylinder) in smaller.

For energy quanta of light radiation, photons, coloured lights, violet, indigo, blue, green, yellow, orange, red, travel in spiral orbit formations around the axial line of motion, almost close upon each other, forming concentric closely packed cylinder layers of spin tracings in space. Hence there is space within the ultraviolet spin tracing cylinder, and still higher energy level particles to travel at velocities higher than ultraviolet light. These are charged nutrinos (not neutral neutrinos) and monons. Electrons, negatrons and positrons also move with these spin tracings.

Behaviour of energies smaller than ultraviolet light particles

As radiation energy of light is produced through creation of a photon from coalescing of a proton and an electron, and realease of Excitation/binding energy as radiation.

$p^{plus} = 1.008130$ mu
$e^{minus} = .000538$ mu
p^{plus} plus $e^{minus} = 1.008668$ mu
which is higher than mass of hydrogen at 1.00800 mu.

The excitation energy released has mass (as light and heat) = 0.000668 mu.

Excitation Energy $E_x = k_2 . n$.

where k_2 is a number

and n is = mass of binding nutrinos

For $k_2 = 5$, $E_x = 5.n = 5 \times .000134$ mu

where .000134 represents the mass of the nutrino.

On creation of a 'photon' its energy mass is about = ·000668 mu.

The energy of a single nutrino has an infinitesimally small mass, about 1/5 that of an electron. Its mass is therefore very much less than that of a photon of light.

On disintegration of a nutrino (this a charged energy particle, not neutrino of neutral charge), the binding energy is released in the same manner as for a photon of light, and similar for the still smaller 'monon' too that has almost 1/9 the mass of a nutrino, being about ·00001345 mu. In case of turbulence at origin, these nurrinos and monons can respectively travel in spin tracings of smaller and smaller diameter, and of greater and still greater velocities, than the ultraviolet light spin tracings, and can influence the reduction in speed difference by the one attracting the other on passing by inside the concentric cylinders of spin tracings, and thereby pulling up the speed of the other slower one.

Relation of Quantum energy with speed and wave length

Let $\lambda_{uv}, \lambda_v, \lambda_i, \lambda_b, \lambda_g, \lambda_y, \lambda_o, \lambda_r, \lambda_{ir}$ represent the wave lengths of ultra violet, coloured lights and of infrared energy particles, and their energies are represented as $E_{uv}, E_v, E_i, E_b, E_g, E_y, E_o, E_r, E_{ir}$.

Now $E = mv^2 = mc^2$ (for light energy)
$= m \times \frac{k^2}{\lambda^2}$

hich means that for smaller wave lengths, uantum energy carried per unit mass is reater.

Now wave length λ is proportional to half pin length traced by the moving particle of nergy in space

Hence $\lambda = k_i$ x ($\frac{1}{2}$ spin length)

or $E = m. \frac{k^2}{\lambda^2} = \frac{mk^2}{k_1{}^2 (\frac{1}{2} \text{ spin length})^2}$

$= \frac{k^2}{k_1{}^2} \cdot \frac{m}{(\frac{1}{2} \text{ spin length})^2}$

As λ_{ir} is > than λ_{uv}, this means that E_{uv} s greater than E_{ir} per unit mass.

Similarly c_{uv} being greater than c_{ir}, the quantum energy for ultraviolet light E_{uv} is greater than quantum energy for infrared light E_{ir} per unit mass.

Penetrating power being proportional to speed of impact, and inversely proportional to density of the medium, for a given density of medium the penetration power of ultraviolet light is greater than infrared light and similarly this holds for the coloured lights in series.

If P_{uv} is the penetration power of ultraviolet light, and D is the density of the medium of a shell, and S the space travelled inside the medium as mean free path, at velocity c_{uv}, then P_{uv} and S are functions of D.

Then $P_{uv} = k. \frac{1}{D}$ where k is a constant.

$S = k_i \times \frac{1}{D}$, where k_1 is another constant,

and $v_{uv} = \frac{S}{t} = k_2 . S = k_2 \times k_1 . \frac{I}{D.}$, where k_2 is a third constant.

As P_{uv}, S and v_{uv} are functions of D,

then, $\frac{d}{dD}(P_{uv}, S, v_{uv}) = P_{uv}. \frac{dS + dv_{uv}}{d_D}$
$+ S. \frac{dP_{uv} + dv_{uv}}{dD} + v_{uv}. \frac{dP_{uv} + dS}{dD}$

or $d(P_{uv}, S, v_{uv}) = P_{uv}(dS + dv_{uv}) + S(dP_{uv} + dv_{uv}) + v_{uv}(dP_{uv} + dS)$

or, $P_{uv}, S, v_{uv} = \int P_{uv}(dS + dv_{uv}) + \int S(dP_{uv} + dv_{uv}) + \int v_{uv}(dP_{uv} + ds)$

or $\int P_{uv}(dS + dv_{uv}) = P_{uv}, S, v_{uv} - \int S(dP_{uv} + dv_{uv}) - \int v_{uv}(dP_{uv} + dS)$

which gives the penetration power required to pass through the mean free path of a shell of density D.

Nature of motion of a quantum of energy

The nature of motion of a quantum of energy is considered here as not in the form of a particle of energy riding on a wave, or simple motion by jumps. It is postulated here that the motion of a quantum of energy is a continuous motion of a quantum along a spiral path around the axis of motion, which gives it the appearance of riding on a wave. It also appears to be a motion in jumps due to the apparent crossing of the spiral path across the axis of motion with each half wave length completed. There are two apparent crossing overs in a full wave length of the spiral path.

The momentary position of a quantum of energy of mass m, in its path which is a curve in three dimesions, is given by the radius vector $\bar{r}$ from the origin O of the

chosen coordinates. The velocity of the quantum of energy v, is given as

$$\bar{v} = \frac{ds}{dt}, \text{ t being time,}$$

The direction of the velocity vector, coinciding with the tangent to the curve of the spiral, its magnitude is :

$v = \frac{ds}{dt}$, where s is the distance measured along the curve from a chosen starting point P.

The acceleration of the quantum particle is

$$\bar{a} = \frac{d\bar{v}}{dt}$$

The direction of $\bar{a}$ does not coincide with that of v, but lies in the osculating plane of the curve. Resolving the acceleration into two components at right angles, namely the tangent and the principal normal to the curve,

$a_t = \frac{dv}{dt}, a_n = -\frac{v^2}{x_1}$, x_1 being the radius of curvature at the point under consideration.

If a_t is constant at uniform acceleration, then $\frac{dv}{dt}$ is constant. The minus value of a_n shows that the quantum has an acceleration towards the axis of motion, which creates a tendency to shorten the diameter of the spin, and hence the wave length, and hence to raise the energy to a higher energy state.

At mid-point between two apparent crossing over points, the tangential angle the path of motion makes with the axial line of motion is nil, which increases till 90° at crossing over points. At crossing over points there is no horizontal or forward motion. Hence the appearance of jumps and apparent stoppage of motion at these points.

Frequency of such apparent jumps is proportional to half the wave length λ. Frequency of jumps for the adjoining concentric spiral motions also creates a beat frequency which will vary according to the adjacent λ s.

In this sense the quanta of energy move like rifle bullets close on the heels of each other in a series in a line of motion along adjacent spiral paths.

Relativistic effect of speed on adjacent quantum of energy

When a quantum of higher state of energy with its electromagnetic field passes by a quantum of lower state of energy and its electromagetic field, as say for an ultraviolet ray passing by a violet ray, the interaction of the electromagnetic fields and gravitational fields of the energy particles leads to the outer energy particle to be pulled up in speed towards the speed of the higher energy particle. This will cause a reduction in speed difference, or slowing down of the relativistic speed of the two particles or photons. This phenomenon causes an easier bunching of the different colours, helped by their closely differing spins. The reduction of the relativistic speed at this stage causes electromagnetic field reactions, leading to diffraction of light quanta, whose duration is proportional to the relativistic speed of motion of the quanta of energy.

The energy difference is worked out as under :

$$e_{uv} = m_{uv} c_{uv}^2 \text{ , and } e_v = m_v c_v^2$$

Hence $e_{uv} - e_v = m_{uv}\, c^2_{uv} - m_v\, c^2_v$

$= m_{uv}\, c^2_{uv}\,(1 - k.\, k_1)$

where $c^2_v = k.\, c^2_{uv}$

and $m_v = k_1 .\, m_{uv}$

$= m_{uv}\, c^2_{uv}\,(1 - k_2)$

where $k_2 = k.\, k_1$

Hence energy difference diminishes, when $k.\, k_i$ approaches the value $= 1$.

For value of $k_2 = 1$, $e_{uv} = e_v$

For $k = 1$, $c^2_{uv} = c^2_v$

which means $c_{uv} = c_v$, or $m_{uv} = m_v$.

Applying to limiting condition on maximum expansion of the shell, for $e_{uv} = 0 = e_v$, $c^2_{uv} = c^2_v = 0$, or $c_{uv} = c_v = 0$. Also $m_{uv} = m_v$.

This means that the disintegrated masses at the boundary of the shell are all equal in mass.

Relativistic effect of speed on Colour and Temperature of Quantum

Colour effect for a spherical shell with source at centre :

Like falling water particles from a tap, or like a rain drop falling from the cloud, on expansion of a shell of energy and matter the gap between successive quanta of energy gradually decreases outwards due to gravitational force effect. Due to this e_v is pulled up towards e_{uv} and c_v^2 approaches c_{uv}^2 towards the middle distance, and colour turns blue. On approaching the maximum distance from the energy source, due to same reason there is deceleration in speed and the colour of light changes through yellow to red and then to black.

The colour of light emanating from the mass of quantum of energy therefore changes colour, ultraviolet and violet towards middle distance from source, to red and infra red and black boundary towards shell.

In the reverse way when the shell contracts, the flow of energy is towards the source. Through half way distance mass m_1 at shell changes to m_o at source, and where at source gravitational force is maximum. There is accelerating speed towards the middle distance of higher gravity force, and the colour of mass of quantum of energy now moving towards the source changes from dark colour or infra red to red, and through the range of colour yellow to blue, violet and ultraviolet and brilliant white near the source. Here also the blue and violet are nearer the source, and red nearer the shell boundary.

This is also in consonance with temperature. If temperature is T_o at shell, and $T\alpha$ at source at centre of shell, then temperature changes with colour change of quantum of energy's position relative to the source.

The equation $e = mc^2$ changes to $e_1 = m_1 c_1{}^2$ at the shell end of expansion.

For expansion therefore colour changes from ultraviolet-violet—blue-green-yellow-red to colourless black. For contraction the colour change is from black through the whole range in reverse to ultraviolet and white.

Colour effect for an unipolar shell.

For an Unipolar shell, where energy travels from the pole round the shell back to

the pole, gravitational force will be maximum when 50 percent of the mass is concentrated at the end opposite the pole. The constant speed of motion due to radiation undergoes a change. Due to effects of gravitation, speed burst before a point half way to the point opposite the pole source, and again deceleration back to the point opposite the pole, again acceleration past middle point of the other lap, back to the pole source. If the points are marked 1, 2, 3, 4. 5 the colour is blue at point 2, red or black at point 3, blue again at point 4 and white at source due to gravitation, though white for radiation pressure too.

There will therefore be starry dispersion of energy and matter beyond middle distance (measured from pole source to opposite end), and thin but dense dispersion of matter will be expected at the extreme end opposite to source. As density increases, energy per unit area decreases, speed value falls, the thickness of the shell becomes a line, and colour is black.

Colour effect for a dipolar Shell.

For a dipolar shell, circular or ellypsoidal, as both poles are sources of energy though of opposite sign, the forward journey ends at equator, which is the shell boundary limit of expansion. Due to gravitational force there will therefore be speed burst in speed before half way from pole to equator, and slow down to nil at equator, and similarly in the other half in reverse to pole 2, and similar also for the two sectional journeys from pole 2 to equator and equator to pole 1. This means the quantum travels as if in four big jumps, the entire circle of the shell back to its own source.

The colour of the quantum energy (say l light) for normal speed c plus variable spe will be dazzling white at pole, vio due to gravitation at one quarter po to equator, blue at near half point equator, yellow and red at three quart point to equator, and black at equator. T process reverses in the other side beyo equator to pole 2. At near the poles du to curvature and variation in density, colo light will be more. There can be displ of colours near the pole like the auror borealis and australis and Sunset red ne shell boundary. But this will be partly offs as the bunching effect of colours fro quickenting in speed and pulling up adjacent colour rays quanta which will more prominent near the poles.

The pulling up effect of the ultra viol light quantum (photon) is there on othe colour light quanta travelling on th concentric spiral positions. Due relativistic higher speed of light at blue en over that at red end, the pulling up o attraction effect diminishes with deceleratio towards the red colour and infra re positions. The result is ultra violet lig emerges out of the refracting medium of th shell first with a close trailing violet ligh like Raman effect. But the other colo light quanta have their speed absorbed medium of the shell, because their energ is lesser, and the mean free paths for thes are less. The pulling up effect should b less prominent at places of the she continuum away from the pole ends for dipolar system.

For the dipolar system there are also

two points of maximum gravity and of minimum gravity corresponding to the end points of each of the four journey sectors. The points are at the equator for minimum, and at poles for maximum.

Contraction and Expansion of elastic shell with referance to quantum energy.

Location of source of energy in a contracting and expanding shell will be in three forms :

A. Source in the centre of the spherical shell.

B. Source unipolar at one point on surface of a spherical or ellypsoidal shell

C. Source dipolar at two opposite points on the surface, of a spherical or ellypsoidal shell.

Comparative studies are made here :

A. *For source at centre of Spherical shell. Expansion of shell—*

Radiation pressure of quantum of. energy P_R acts outward and is constant. $P_R = mf$. Hence mf is constant with velocity c constant.

At source temperature T is infinite, and mass m is nil. Hence, gravitational force between matter at source M_o and matter at shell M_1 is $F_g = g. \frac{M_o \ M_1}{D^2}$

where M_1 = total mass at shell boundary

M_o = total mass at source or centre.

D = distance from source to shell boundary

At the begininng of transfer of energy operation from source to shell,

Total pressure P = total radiation pressure plus total gravitation force or pressure

$$= P_R \pm g. \frac{M_o \ M_1}{D^2}$$

$= P_R$, for value of $M_1 = 0$ at source with T = infinite ; also for $M_o = o, T = o$

Individual quantum outward radiation pressure for infinite expansion of shell is mc^2 per unit area of shell at border, where P_R is counter balanced by equal and opposite resistance pressure of medium.

Hence for $P_R = 0, c^2 = 0$, or $c = 0$.

Hence velocity outwards becomes zero. As T is zero, density of mass is infinite. Mean free path in shell is zero. Hence velocity rebounds, that is deflected straight back towards the source. Contraction starts.

The tangential gravitational force between adjoining quanta of energy on the shell helps the process of contraction.

Contraction of shell :

Reverse process takes place. Velocity c being inward. radiation is inwards. M_0 at source initially being $= M_0 = 0$, radiation pressure converges to a pin point at source at centre of the shell.

$$\text{Total force } P = P_R \pm g. \frac{M_1 \ M_0}{D^2}$$

As M_1 decreases and M_0 builds up Treaching to wards infinity,

$$\text{The total force } P = P_R \pm g \ \frac{M_1 \ M_0}{D^2}$$

changes to

$P = P_R = m\,c^2$, for $M_1 = 0$

Hence pressure at source is then only radiation pressure, and condition reache back to initial stage of expansion operation.

B. *For source at a point on a spherical shell (Unipolar system)*

$$\text{Total force } P = P_R \pm g.\ \frac{M_1 M_0}{D^2}$$

Here the main difference from the system with source (pole ?) at centre of shell is that the path of the quantum energy is curved along the shell instead of straight from shell boundary to source.

The system is unstable in the sense that the point opposite tends to become a pole with dispersal of energy.

For $M_1 = M_0$ here also

$$P = P_R \pm g.\ \frac{M^2}{4D^2}, \text{ where}$$

$$M_1 = M_0 = \tfrac{1}{2} M$$

which in next stage reduces to $P = P_R$, when $M_1 = \frac{1}{2} M$ reduces to 0, that is, combined radiation and gravitational pressure changes to $P = P_R$, that is to radiation pressue at the point opposite the pole. Hence there is pulsatory effect of force at the point opposite the pole, besides instability of reducing to a pole.

C. *Source at two opposite points on a spherical shell or ellypsoidal shell (Dipolar system)*

For the system the shell boundary position is at the equator line, the line of maximum expansion.

Here also while radiation pressure on the quantum is uniform with velocity c, the graviratlonal pressure is added under equation :

$$P = P_r \pm g.\ \frac{M_1 M_0}{D^2}$$

where D_1 is now one fourth the circumference of the shell.

For each quarter of circumference of the shell, colour due to speed varies in each of the segments. The colour of the quantum changes towards blue around the mid-points of each of the segments of total path. Nearer the equator the colour turns through yellow to red, and at polar sources blended brilliant white where values of e and T are maximum, and speed is c., which at pin point is zero with gravitational effect on speed.

The result is, at the poles due to balancing of gravitational effect, the quanta of light and other photons come closer, there is more blending of light colours to white, and near poles there is also display of colours for dipolar shells due to increased curvature of the refracting shell medium. The electromagnetic field is more powerful over the segments of the path than at the equator. At pin point all mass is converted to energy.

Functions of quantum of energy in principles of contraction and expansion of elastic shell

When a quantum or energy travels from a pin point source to extreme boundary of the shell, or from a pole to the opposits point on a shell and again back to the pole, or from a pole to equator, and from equator to pole of a spherical or ellypsoidal shell, the series of quanta moving along an axis line of motion, are subject to two forces, Radiation Pressure P_R, and Gravitational Force F_g.

The Radiation force P_R has constant velocity v=c for light. For the relation between two successive quanta subject to Radiation pressure or force and to gravitational force, and to deceleration in each segment, the force equation due to gravitation is given as under :

$$F_{g1} = g_1 . \frac{m_1 m_2}{d_1^2}, F_{g2} = g_2 \frac{m_2 m_3}{d_2^2}$$

where m_1, m_2, m_3 etc are the masses of uanta of energy taken from direction of ource. Starting from source the gravitational ffect on the quanta will be very high, the otal force on the quanta will also be very igh, Hence total force F_{g1} will be greater han F_{g2}.

Hence $\frac{m_1 \ m_2}{d_1^2} g_1$ will be higher than

$$\frac{m_2 \ m_3}{d_2^2} . g_2$$

or $m_1 \ m_2 \ g_1$ will be $>$ than $m_2 \ m_3 \ g_2$ and $d_1 >$ than d_2.

Also $g_1 = x_1 \ g$, $g_2 = x_2 g$, where $x_1 > x_2$, x_1 and x_2 being variables.

The gap between successive quanta will decrease, and the blue colour will change to yellow colour, and temperature will diminish. At mid point of the sector or segment of path the speed will further fall and the gap between successive quanta closes. With deceleration in speed, coiour changes through green, yellow to red, and then to black, the temperature diminishes and due to gravitational effect, the (g) speed diminishes towards boundary of the equator to zero. The speed regains its value on reflection back when free nil of gravitational effect at border, with its restarting back value at c as for P_R.

The quantum of energy is thus subject to speed variation 4 times in the entire lap of the shell, and also 4 times to fluctuation of energy and temperature. This will be examined more closely in a later part.

At the poles while temperature is maximum on full contraction, and the gravtiational pressure is balanced, the Radiation pressure exists to full, and on start of expansion, changes over to initially following formula $e = m c^e$.

At the shell the temperature turns nil at maximum expansion, and gravitational effect is also nil.

The quanta of energy reaching the pin point source of pole, is momentarily stabilised. At pin point there is a great deal of bombardment, hence rise in temperature sharply, otherwise than from steady contraction of continuum shell. The mass being nil, energy infinite (for universe condition), the mean free path in infinite, density nil. Hence containment it is difficult, instability increases, unmatching with gravitational force occurs, expansion starts with velocity the speed of light c, which gradually changes due to increased gravitational effect, as it comes to play.

Density and mass of a quantum of energy in relation to motion :

In a field of energy with an elastic spherical shell, the centre of source of energy is the centre of maximum radiation pressure, hence of constant radiation speed for the particles of energy due to the pressure. The spherical shell with source at centre represents the area (shell) of maximum mass and relatively minimum energy per unit of area. For dipolar shell, the area near the equator is the area of minimum energy per unit of shell area.

For mass distributed on a spherical shell with source at centre, the resultant centre o gravity is at the centre of the shell. The centre of gravity of gravitational field therefore coincides with the centre of maximum energy radiation.

During expansion of the elastic shell, the quanta of energy flow out of the central source at a constant speed of motion, against a changing gravitational field. The quantum is therefore in addition subject to acceleration and deceleration due to the gravitational force of the system. As expansion comes to a halt, force of gravitation tends to zero value, but P_R the radiation pressure per unit area and velocity c remains.

When the shell contracts, F varies in each half of the 4 segments of the total path (from source back to source). Temperature T correspondingly varies therefore, and inversely the density of mass. At the extreme boundary of the shell the thickness of the mass comprising the shell diminishes theoretically to a line without thickness, but with increased density of mass along the radial direction. The density of the quanta along the tangential direction however falls, as the mass m becomes smaller at the shell line, and distance d between two consecutive masses increase with diminution of quantum energy per unit area along the line of the shell boundary. Matter therefore ranges as if in a discontinuous line of gaps and dots, with a very weak electromagnetic field between two consecutive dots of energy and matter. Here, shell line of matter is taken as transverse to the direction of motion of the mass, that is taken along the line of the tranverse circumference.

For a dipolar system the transverse direction is the line of the equator with source of energy at the two poles. If a quantum of energy of high velocity impinges on a matter (dot] direct at the shell boundary, due to the extreme density of the dot matter, the speed of energy will rebound like two billiard balls. If it impinges between two dots of energy matter, the electromagnetic field between the two dots of energy matter, may normally prevent the impinging energy dot from moving out of the shell boundary, or simply trrnsfer the energy by diverting it to the two adjacent quanta dots. If the energy has speed more than c (speed of light) and mass lighter than a photon, the gravitational field between the two adjacent dots of energy and matter, may not be sufficient to hold baek the quantum of bombarding energy, or divert its energy to the two adjacent dots of matter and energy.

Successive quanta of energy of the size of a photon or free electron theoretically pass in a line straight from source to shell boundary in a radiating manner for a spherical shell with source at centre. These quanta follow similar but curved paths on the shell in the case of unipolar and dipolar systems. At the shell boundary, or at the equator, the transverse gaps enlargen, and there are energies in the universe that are smaller than a photon or a free electron, that by virtue of their smallness of matter, may appear to have velocities higher than that of light, and there is possibility of their escape through gaps, apparently following a system contrary to the Laws of Conservation of Energy and Matter. For dipolar system, there is no rebounding due to gravitational effects of second pole.

For large systems comparable to the Universe, as the axis line of the photon and energy particles bunch close together in concentric spirals there is gravitational interaction between the masses transversely, and energy particles tend to lump together, and form larger energy and mass systems of

of their own through a process of build up, which also move in spiral motion along the axis of motion, the transverse spin motion being almost at right angles to the line of motion.

Electromagnetic interaction and relation with axis of motion.

Quanta of energy travelling at different energy levels close packed in concentric spiral spins, create a chain of electromagretic interaction through constantly moving lines of force. This causes instability in flux density, per unit area and per unit time. Consequenty, there is diffraction of energy. The chain of flux disturbance passes outwards with the quantum of state at advanced position in the innermost spiral rings of the concentric rings. There is therefore time lag and dissipation of energy from diffraction and absorption in medium.

The quantum of energy lying away from the axis of motion, is affected by the diffusion from electromagnetic flux densities, and diffraction, with a time lag which is proportional to its distance from the central axis of motion of the quantum, and speed of receding high energy inner ring quantum.

The time lag for colour energies on account of difference in speed of motion can be worked out as under :

For travel of ultraviolet energy photon for a given time T, taking S=distance travelled, we have

$S = v_{uv}\,t + \frac{1}{2}\,ft_2 = v_u\,t_1 + \frac{1}{2}\,f_1\,t_1{}^2$ for ultraviolet and violet rays respectively.

If $v_{uv} = k.\,v_u$, where k is a constant,

and $f = k_1\ f_1$, where k_1 is another constant,

Then the above equation is transformed to

$$kv_u{}^t + \tfrac{1}{2}\,k_1\ f_1\,t^2 = v_u\,t_1 + \tfrac{1}{2}\,f_1\,t_1{}^2$$

$$\text{or } v_u\,(kt - t_1) = \tfrac{1}{2}\,f_1\,(t_1{}^2 - k_1\,t^2)$$

If $t = k_2\,t_1$, where k_2 is a third constant, then the equation is,

$$v_u\,(k\,k_2 - 1)\,t_1 = \tfrac{1}{2}\,f_1\ t_1{}^2\,(1 - k_1\,k_2{}^2)$$

$$\text{or } \frac{t_1}{t_1{}^2} = \frac{\frac{1}{2}\,f_1\,(1 - k_1\,k_2{}^2)}{v_u\,(k\,k_2 - 1)} = \frac{1}{t_1}$$

$$\text{or } t_1 = \frac{v_u\,(kk_2 - 1)}{\frac{1}{2}\,f_1\,(1 - k_1\ k_2{}^2)}$$

$$\text{Hence, } t - t_1 = k_2\,t_1 - t_1 = t_1\,(k_2 - 1)$$

$$= \frac{v_u\,(k\,k_2 - 1)}{\frac{1}{2}\,f_1\,(1 - k_1\,k_2{}^2)}.\ (k_2 - 1).$$

Reflection and Refraction of Quantum of energy

Reflection of light energy on dense medium is caused when the mean free path in the dense medium for the bombarding quantum is nil. On a quantum of light energy hitting the dense medium, it reacts with the electrons of the atom. The intensity and volume of the emitted electron, positron or negatron, will depend upon the energy force and velocity of the incident quantum of energy. However the field strength of the medium being inversely proportional to the density of the medium, the resistance to impact increases with increase in intensity of the incident photon of energy, or of a higher energy particle, that is with the velocity of impact. The mean free path for ultraviolet light energy for any given medium is therefore more than for red

light energy of lower energy level. This also creates a stronger field strength of resistance at the point of impact, and consequentially differential refraction of energy particle, and its spiral wave motion for the different colours.

For harder surface of the medium, that is for heavier density of the medium, the field strength of the medium at point of impact is weak, but with increasing force of impact, it quickly builds up a resistance feld of force, due to increase in density at the point of impact. This resisting force is proportional to the force of impact of the incident energy under energy laws. High velocity of incident photon causes high velocity of resistance force built up. Part of the high velocity photon energy is reflected at an angle. The back thrust causes a back pressure at a direction opposite to the reflected ray. The forward pressure of the incident ray giving rise to the back pressure of the reflected energy, causes a resultant pressure and direction in the medium, in which reflected energy is proportional to the square of the speed of the ineident ray. Hence the different deflections of the coloured quanta of energy.

In an impact with the medium of the incident ray, as for example a quantum of energy penetrating the shell, part of the energy is reflected according th the angle of incidence, and density of the medium.

Here $e_1 + e_2 + e_x = e$

where e_1 = energy travelling in reflection,

e_2 = energy travelling in refraction,

e_x = energy lost or dissipated at the time of change of medium.

e = total incident energy.

or $m_1 v_1^2 + m_2 v_2^2 + m_x v_x^2 = mv^2$

This becomes $e_1 + e_2 + e_x = e$

and $m_1 c_1^2 + m_2 c_2^2 + m_x c_x^2 = e$

for speed of incident coloured lights, and average speed of the light energy from reflection, refraction and dissipation from diffraction.

The diffracting coloured lights being of a monochromatic branch, due to lesser energy level at the red end, the penetrating power of the red quantum will be less than for ultra violet one, Due to pulling up of the violet quantum (photon) by the ultra voiolet one of higher speed in passing, the ultraviolet comes out first with the violet trailing behind, but other slower speed light colours of shorter mean free paths are mostly absorbed in the medium or dissipated. In clearer medium they refract out at different angles of emergence.

Source of Electromagnetic propogation of energy. Density and Temperature

As explained earlier, quantum of energy radiate out in concentric spiral motion (for each ray) in all directions from the centre of turbulence or source. There is variation in temperature proportional to the extent of turbulence in the source.

An increase in density of medium means more mass per unit area of the mass, and less energy (kinetic) as at the shell. Lessening density towards the source means less mass per unit area. More energy in unit area near source of turbulence or near source will cause more turbulence or collisions due to motions of the energy particles. This creates high temperature of energy, which in turn causes increase in volume.

In the electromagnetic field created by quanta, the change in state from the her energy level to lower ehergy level ses a pressure towards lower energy level, ich is

$e_1 - e_2 = m(v_1^2 - v_2^2)$,

where e_1 is the higher energy level, or rgy level towards the source of turbulence. This pressure difference of energy levels lependent on variable v^2 for a constant antum of energy and hence on accelera- n or deceleration of speed, that is on the ivitational force it is subjected to.

On escape from the electromagnetic d of the source of energy or of turbu- ice, the emerging quantum of energy is ady to travel forward at a constant speed, e speed due to radiation pressure (for ht $v=c$), subject to flux retardation and x density of near large sources of energy, d bending of its path near same.

adiation pressure on energy quanta

The thrust power of a quantum of energy due to the movement of the quantum of nergy from high energy level electromag- etic flux area to low energy level area, hich means from high temperature to low mperature area.

The behaviour of the released quanta of nergy is much like diffusion of gases. If A the plane of high temperaturc, and B is at of low one, then the rate of diffusion of $_{uv}$ will mean A will lose energy E_{uv} and B vill gain some of these. This will go on ntil the quantities of E_{uv} in unit volume of A and B are equal. If there are n amount of uanta of E_{uv} in unit volume of B, and +dn in unit volume of A at distance d_x from that in B, and if x is measured at right angles to the plane separating the two areas A and B, then the excess of the number of E_{uv} quanta of energy which go across unit area of C, the separating plane, from A to B over those which go from A to B, is according to Boltzmann, $\cdot 3502\ \lambda_1 \overline{c}\frac{d_n}{d_x}$, where λ_1 is the mean free path of E_{uv}, and $\overline{c}$ their average velocity of translation, The quantity $\lambda_1 \overline{c}$ is proportional to the diffusity of the E_{uv} energy quanta.

Now $\overline{c}$ only depends upon the temperature, being proportional to the square root of the absolute temperature, while λ_1, is inversely proportional to the density. If the pressure is known, then density will be inversely, and λ_1 directly proportional to the absolute temperature.

If d_1 and d_2 are respectively the densities of the E_{uv} quanta, and P_1 P_2 the external force per unit mass, acting on the quanta of energy respectively, and p_1 and p_2 the partial pressures respectively, then the external force is $p_1 d_1$, and force due to variation of partial pressure is $-dp_1/dx$. Hence total force is equal to $-dp_1/dx + p_1 d_1$, andthis is the force or radiation pressure along with gravitation pressure driving the quanta of E_{uv} from A to B area.

The equation of radiation pressure is than

$$\frac{-dp_1}{d_x} + P_1 d_1 = A_{12} d_1 d_2 (v_1 + v_2),\ \text{where}$$

v_1 is the average flow rate of energy from A to B, and

v_2 is relativistic flow rate of energy from B to A, all parallel to the axis of flow x, and A_{12} is a quantity depending upon the nature of quanta in A and B, but not upon their densities, nor on $\overline{c}$.

This radiation cum gravitation pressure is the forward thrust pressure from high temperature area to low temperature area, low density area to high density area of mass.

Universe border condition at infinity

Equation for Radiation is—

Radiation pressure ρ_1

$$= \frac{A_{12} d_1 d_2 (v_1 + v_2) + \frac{dp_1}{dx}}{d} = m\bar{c}^2$$

where $\bar{c}$ is the speed of diffusibility.

At Universe border condition, taking d_1 =nil, ρ_1 is the total radiation pressure, and =infinite at infinity condition, that is concentration of energy per unit mass is almost nil. The rate of diffusibility is practically nil, and temperature the absolute temperature T_0 at shell.

As λ_1 the mean free path is proportional inversely to density, density of tangential dispersion of quanta along the shell line tends towards zero value. Hence λ_1 is infinite, or the mean free path of travel in space outside the Universe shell is infinite.

This show the infinite outer space outside the Universe shell border, can be f of charged particles of zero mass, and a total infinite quanta of energy. It a shows that when radiation pressure ins the border is equal to the flux pressure fr outside the border, then c = o. But radiation as radiation velocity c is not aff ted, while force of gravity is nil inside system at the shell border, the quanta energy of the size of monons and nutrin can frely pass in and out of the bor through infinitely long mean free path o side.

The shell system of the Universe w charged matter has a magnetic field outsi While the velocity c of the radiation pr ssure can take the nutrinos and mono outside the universe border through t interspaces with weak electromagnetic fie any pressure built up of charged particl outside will create a speed of diffusibility creating a flow towards the border fro outside and to inside, and maintain a sta of equilibrium of forces.

The Universe border is thus like a sie that can allow infinitely small charged pa ticles with velocity of speed of light to mo to and fro through the interstices of th shell. *(To be continued*

ANOUNCEMENT

Due to Special Science Number issue, Scheduled articles for September issue will be published in a future issue.

—Editor

NUCLEAR MEDICINE, SOME ASPECTS

By

T. G. KRISHNA MURTHY*

ABSTRACT

Instrumentation is playing an important role in this branch of medicine as in other branches. A very wide range of instrument are utilised in medical diagnostic and therapeutic measures utilising radioactive istopes aud radiation. Radioactive tracers find application in bioanalytical work. The unseen radiation hazards warrant safety precautions. Personnel and area monitors ensure the monitoring of radiation levels within the permissible limits. This paper summarises the activities (instrumentation) in Indin.

Nuclear medicine is yet another recent inter disciplinary effort involving the utilisation of radiation and radio isotopes in medical diagnosis and therapy. Special care and skill are essential to handle the fairly costly specialised instrumentation necessary. Compact departments of nuclear medicine have to be set-up to evolve a planned approach for utilising the radioactive materials. As a first step such departments competently staffed and equipped can be set up in the medical colleges of the country. The cost aspects (recurring and non-recurring) are of great consequence There is no dearth in regard to the availability of highly competent personnel in this field. Almost all the instruments needed are being manufactured in the country. The reagents and radio isotopes needed are also being produced. Besides refresher courses are being regularly offered by BARC to educate medical personnel about the safety aspects, highly competent engineers/physicists specially trained in health physics are available for being utilised in the departments of nuclear medicine/radiology. The lack of financial resources in medical institutions in the country have to a great extent inhibited the rapid growth of this interdisciplinary activity. In fact, the same applied to another interdiscipline names biomedical engineering. A practically realistic step to promote such interdisciplinary activities which makes impact on medical diagnosis and therapy is to upgrade some of the major hospitals and medical colleges in various parts of the country. Such a step can lead to promotion of medical research and also gainful employment of highly competent intellectuals. Health care is normally the concern and responsibility of the concerned

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State Governments. So almost entirely the utilisation of modern techniques in medical diagnosis and therapy depends on the dynamisim and initiative of the directorates of health services of the concerned States. One is conscious of the limited financial resources available for health care programmes. Essential medical and surgical requisites of a hospital consumes over 70 per cent of the funds. Better management of the remaining funds can yet promote new techniques. In fact many new techniques are safe, simple and clinically useful involving title funds. Interdisciplinary coordination and mutual regard can lead to improved instrumentation and better utilisation.

Nuclear medical instruments find a wide range of applications. Organ imaging is one major application which shows the presence or absence of space occupying lesions. This is helpful in the anatomical localisation in case of positive diagnosis. Imaging of brain, lungs, liver and bone is extremely helpful in detecting the secondary spread of cancer once the primary is established. This is helpful in planning future therapy. The greatest advantage of this technique is obviously its non-invasive nature.

The usefulness of radio isotopes needs no introduction. However in the past, only superficial and deep x-ray units besides radium and radion needles were the only means available. Advancements in the last two decades had led to the availability of a large number of reactor produded (gamma and beta emillers). The radiotherapist in the present day has wide range to select from and use it for the selective irradiation of the tumour. Broadly they are utilised for external radiation (sealed sources), interstitial implants, intracavitary use and for internal administration.

Renal scanning and isotopic tenography are extremly useful diagnostic aids in the practice of urology. They are simple and sensitive renal tests deviod of any complications. Hippuran renal scanning is an useful test in the management of obstructive usopathy and chronic renal failute. Renal imaging is an invaluable diagnostic tool in the diagnosis of space occupying lesions of the kidney and undetermined abdominal lumps.

In the fields of endolrinology and haematology also, radio isotopes find utilisation. Most procedures require in vivo administration of the labelled substance. Measurements are made at anatomical locations where the labelled substance accumulates. In some cases the rate of appearance or disappearance of the labelled substance in urine, blood, stools is determined. The clinical application of radio isotopes became more frequent with the advent of 51 Cr labelling technique and 58 Co Vit B 12 urinary excretion test. The most commonly utilised isotopes are 51 Cr, 58 Co, 59 Fe for diagnostic work and 32 p for therapy and bolyiyltemia Vera.

The noninvasive nature of the techniques was in fact a major impetus for developing nuclear angiocardiography. No doubt cardiac caltheterisation is the method of choice for the detailed anatomical evaluation of heart lesion. There is always certain amount of risk for a patient undergoing catheterisation. Three groups of patients can be evaluated namely (a) Patients for whom calteterisation is planned (b) Patients

or whom a definite diagnosis is required and c) Post operative sequential assessment. In the field of diagnostic neurology, a need has always been felt for a simple test which can be more accurate than EEG, echo EG and skull radiographs for the early detection of intracranial space occupying lesion. Brain scanning using radio isotopes provided a technique.

After mentioning some of the techniques utilised, it is obvious that mention is made of the instrumentation set-up needed. Broadly it falls into 4 categories namely (a) set-up for measurement of radio activity in vitro in samples (b) devices for in vivo measuraments in organs or parts of the body (c) equipment for the x-ray fluorascence technique and (d) instruments for safe handling of radio isotopes. In all these, the basic unit after the radiation source is obviously the detector. The medical spectrometer is an example of the set-up for thyroid uptake studies. Broadly it comprises of the detector, amplifier analyser and scaler-timer unit well type scintillation counters are used for in vitro studies. Scanning is now widely utilised. A wide range of radio pharmaleutical coupled with the associated instrumentation enables scanning almost every organ in the body. Clinicians are now able to gather more specific information by scanning than by other establised clinical and laboratory methods.

No note on nuclear mecical instrumentation can be complete if one fails to mention the name of ECIL. One has to trace the chain from the TIFR thro BARC thro ECIL which is a unique phenomena witnessed in the last two decades in our country. It has been a unique integrated realisation of the practical results of fundamental and applied research efforts. The transition here has been smooth leading to practical results. It has not been so in the case of translation of research and development efforts into practice in national laboratories under other agencies. The ECIL now has fully equipped workshops to undertake any sophisticated instrumentation work. The personnel available are now fully mature having gone thro the stages of design, development, manufacture and marketing. It is rather difficult to get such intellectual team work under one roof. The ECIL started as a byproduct of BARC to manufacture nuclear instruments has how surpassed all expectations to become a leading manufacturer in the world. The ECIL despite all its attainments continues to evince special interest in the development and manufacture of nuclears instruments. From both commercial as well as professional viewpoints the ECIL has been a partner in promoting the growth of this interdiscipline namely nuclear medicine.

Concluding, the future growth and expansion of activities in this branch of medicine depends to a large extent on the users namely medical profession besides financial resources. Departments of Nuclear medicine which are well equipped and competently staffed must be established in the hospitals/ medical colleges located in the leading cities. Obviously certain inherert facilities in regard to transportation of radio-iostopes maintanence of equipment etc., These centres may be on the lines of the Radiation Medical Centre. It is better to have restricted number of such centres Dedicated team of interdisciplinary workers are an absolute essential part of such a set-up. Compared

to other branches of medicine or engineering this cannot hold any attraction of monetary gains. But it does ensure immense professional satisfaction for both the technologist and medical specialist.

BIBLIOGRAPHY

Special Issue on NUCLEAR MEDICINE

Indian Practitioner. Vol 29 No. 5 pp 243–35

Forth Coming Events

The Instrument Society of India is sponsoring the 2 days seminar on Engineering and Health Care at Mysore on November 11-12. 1978. Top Medical and other experts will deliver lectures on Techniques, Nero Phychiatry, Behaviour Therapy, Management of Health Care Institutions, Aviation Medicine, Nuclear Medicine ; Speech. hearing, Physical Medicine. Occupational Health, Non invasive techniques etc. Among other features there will be Film shows, popular lectures and Exhibition. Registration Fee is Rs. 100/- per delegate. For details contact—T. G. Krishna Murthy, Co-ordinator, Engineering and Health Care Seminar, Instrument Society of India. C.I.S.L. Building, Indian Institute of Science, Bangalore—560 012.

The University Grants Commission, New Delhi will sponsor a symposium on Appropriate Technology for Rural Development from October 10 to October 20, 1978 at TKM College of Engineering. Quilon, Kerala.

The main object of this symposium i bring together people from different dis lines to discuss :

1. The role Technology in Society elaboration on the concept of Appropi Technology.

2. The criterion for choice of Tech logy.

3. Alternate energy sources and t applicability.

4. Case studies on application of Ap priate Technology for Rural Developmen

5. The role of Institutions like, Coll and Universities, Government Agenc Bank, and Financial Institutions, Tr Unions and Labour Welfare Organisatic Voluntary Organisations and other bo in the transfer of technology. Furt details can be had from The Secret Organising Committee, Symposium Appropriate Technology for Rural Deve ment, Appropriate Technology Cen T. K. M. College of Engineering, Q 691005.

OUR AUTHORS

Dr. T. K. Das

Dr. Tapan Kumar Das, a Jagadish Bose National Science Talent Search Scholar was educated at the Presidency College, Calcutta obtained B.Sc. (Hons) degree in 1963 and M.Sc. degree in 1965 from University Calcutta. He obtained Ph.D. in Theoretical Nuclear Physics from the University of Pennsylvania (Philadelphia, U.S.A.) in 1971. He did his Post Doctoral work at the Technische Universitat Munchen (Munich. West Germany) from 1971 to 1972. Dr. Das joined the Universidade Federal de Pernambuco (Recife, Brazil) as Professor to the Chair of Nuclear Physics in 1973 and served there for 3 years. He has wide experience of guiding research in Theoretical Nuclear Physics. He has published a number of research papers in the field of Theoretical Nuclear Physics and Ecology in National and internation journals of repute. Presently he is associated with the University of Burdwan.

Mr. U. P. Mullick

Mr. U. P. Mullick was educated at the Presidency College, Calcutta and Bengal Engineering College, Shibpore obtained B. Sc. (Hons) degree in Physics in 1926 and B. E. in Civil Engineering in 1929 and received Heaton Gold Medal for Civil Engineering Design and Architecture. Mr. Mullick started practice as Consulting Engineer as a Partner of M/s Hope Johnstone & Son in 1933 and how he is the principal of the firm, with extensive all India practice as Consulting Engineer, Architect, Valuer, Town Planner and Industrial Consultant.

He contributed National Reports on Planning for EAROPH, and Reports for S. E Asia Economic Commissiors (EAROPH and FIHP) on Planning and served on the Council of the EAROPH. Prepard the unofficial Report on 'Habitat' for UN (Vancouvre) Meeting on Planning for India. He made extensive contributions by way of technical papers on the Theory of Metropolitan, Urban and Rural planning and Regional planning, contributing both to the Research section Planning Commission, Government of India, Reserve Bank of India and associated over years with Seminars on Town Planning of Town & Country Planning Institute, Delhi. He prepared the first **Master Plan for Greater** Calcutta (1960 **Bangalore Seminar** and on Utilities, Services and Community facilities (Electricity, Water and Drainage etc.) for Greater Calcutta (1961 Madras Seminar), and for Community Development Seminar Hyderabad (1959), in Bombay Seminar for AICP Seminars on towns (1958), and in Housing Seminar (1956) of NBO at New Delhi)

He was elected Associate Member of Institution of Engineers (India in 1942, and Member in 1956,. Elected Member Association of Engineers in 1956 and in its Council since. Elected Member of India Societ

of Engineers in 1956, become its President in 1966, and its Honorary Fellow since. He was the Founder President and Fellow of Institute of Consulting Engineers since 1958 was elected member of Institution of Welding (London) in 1957. He is the Founder President of India Inter Planetary Society 1963, elected a Fellow of Mining, Metallurgical and Geological Society of India in 1965, elected Member of Royal Society of Health (Lond) in 1958, and Fellow in 1965, elected Members of Institution of Surveyors in 1959 elected Member IndianR ocket Society in 1968, Member EAROPH in 1956, Member Institution of Valuers and Fellow 1968, and its Chairman, West Bengal Zone in 1974. He is Founder President and Fellow of Valuers' Institute since 19 8. Member New York Academy of Sciences elected in 1960, Member Institution of Industrial Engineers (India) in 1965, President and Founder of Federation of Professional Engineering Institutions of India in 1973.

He is responsible for over 300 Technical and Engineering papers published in various journals in all branches of Engineering and technology and responsible as author for 25 scientific publications papers and books, 40 literary books, and over 50 philosophi books.

T. G. Krishna Murthy

Graduated from Mysore Univers (1951); Completed Post-Graduate Electroni Course at Madras Institute of Technolo (1955); Research Fellow in Biophysi National Institute of Mental Health a Neurosciences (1958-1961); part time Tut St. John's Medical College (1964-1968); He Adviser and Consultant to Industry, medic Institutions etc; Member, ICMR Panel BME, Medeless panel Electronics Commi ssion, Advisory Committee of Advanc Training Institute on Process Instrumentatic and Electronics, Hyderabad; has over 2 publications to credit in the field coveri varied aspects like safety, developmer manufacture, maintenance, marketir techniques; on invitation attended semina and symposia in India and abroad memb of several professional organisations in t field. Hon. Guest Editor, issues on BME.

Articles and Notes are invited by the Editorial Board for publication in SCIENCE & ENGINEERING. Readers Views and Comments will be specially appreciated.

CONDOLENCE

Letters exchanged between President of the Society and H. E. Bharatratna V. V. Giri, Honorary Fellow, on the demise of Lady Saraswatibai Giri.

★

Calcutta,
17-8-78

Your Excellency,

Kindly accept our heartfelt condolence on the passing away of Lady Saraswati Giri. We pay our homage and respect to her memory.

May her soul rest in peace :

With regards, I remain,

Yours faithfully,
Sd/- U. P. Mullick,
President.

★

New Delhi-110017

My dear and exteemed friend,

I thank you for your most affectionate communication expressing sorrow on the demise of my dear wife. Saraswatibai Giri. Message from friends like you give me strength to bear the loss.

With kind regards.

Yours faithfully,
Sd/- V. V. Giri

Stand by the flood Victims

Main Text of Resolution moved from Chair at the meeting of the Executive Committee of the India Society of Engineers held on September 15, 1978 :

The President and Members of the Executive Committee of India Society of Engineers, on behalf the Society express their deep sorrow at the death of many of our of Countrymen, Women and Children as a result of this current unprecedented flood havoc. A two minutes silence is observed standing in memory of the dead.

The India Society of Engineers express further their deep sympathy with the surviving people striken by the flood and its after math, and resolves that its members be requested to forward their donations freely to the Society earmarked 'The Chief Ministers' Flood Relief Fund' to maximum possible extent in this hour of distress of the flood affected people.

The Society also sympathises deeply for the loss and death of hundreds of domestic cattle due to the devastating flood.

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CONTENTS

SCIENCE & ENGINEERING

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CONCEPT AND EQUILIBRIUM CONDITION IN FINITE NATURE

The kind of state of phenomenal Nature which is distinct and distinguishable, is comprehensible in conception. Dr. Chakravarty has defined this state as equivalent of condensed phase having aggregate existence in concept. The other state of existence in Nature is abstract in concept. The state, he defines as something which is indistinguishable in conception, that is, there is nothing in this state which would be something concrete or objective, relative to which a description, conceptual or mental picture, of this state can be made.

The two abstract states are in equilibrium combination. One of these two states may contain only One, and the other state in combination may contain absolutely nothing, also an abstract state, as in the case of a resultant gravitational force through pin - point centre. Such a wholly abstract state is a critical state. Duration of material existence in a critical state is naturally infinitely small. This dictates, therefore, that in the concept of Universal Nature, anything by alone in existence must lead to manifestation, that is, there will be a change over automatic from one state to another.

In natural phenomena there is a progressive evolutionary manifestation with respect to a yard stick like temperature. The phenomenal manifestation changes from a previous phase to a next phase combination through a critical state. The previous phase combination above the critical state is eliminated, and a new phase in next combination appears below the critical, and assumes maximum intensity, and becomes an abstract state. These progressive states lead from nothing to gas balls, then to liquid then to solid phase, and vice versa. Hence there are more than one critical state in phenomenal manifestation.

This process of evolution from one state to another through a critical state is carried out through a mechanism of Nature, one which a quantitative mechanism of evolution has been suggested by Dr. K. R. Chakravarty. If the process of evoluation of phenomenal Nature starts from a wholly abstract state where only One existed assosiated with nothing (e.g. unitarily located total energy at a pin point source

without mass) to a state where there will be generated concrete or objective positions in equilibrium with and distributed in an indistinguishable phase (as in case of manifested Nature through radiation of energy and under a force of gravitation into gas, liquids and solids distributed in different shapes of combination over the entire continuum of shell of energy), then the distribution of the generated objective positions with respect to the state of Oneness has to be, as Dr. Chakravarty says, absolutely isotropic and simultaneous. They will also be identical and perfectly isotropic with respect to the one (fundamental) from which they have been generated or have emanated. The other condition of the process of evolution is that with respect to the generated objective derived positions. The other generated positions must also be isotropic simultaneous and identical. These are the two great Laws, fundamental laws of physics and chemistry in Nature, from the state of Oneness to diversity and vice versa through critical states.

In a regular tetrahedron crystal the centre of the tetrahedron O, the origin point assumes the position of the state of Oneness as the first critical state and the four corners A, B, C, D of the tetrahedron asssume the generated objective positions. All the four corner positions with respect to the centre are perfectly isotropic and identical with respect to the centre on the one hand, and on the other hand with respect to the generated positions. Thus the other generated positions are also isotropic. This chemical phenomenon when viewed physically, is apparent in the distribution of the generated atoms, electrons and protons whose nature and behaviour and formation are identical to each other in a group and to the basic energy concentration as Oneness at pin point source.

Thus a regular tetrahhdral mode governs the process of evolution of Nature. With further progress of evolution, each of the objective positions of the four triangular faces has the tendency to converge isotropically into the position of their oneness. This is achieved when four regular tetrahedrals are added to the four triangular faces of the evolutionary tetrahedron under a second critical state.

In the result there will be four such positions. Oneness at the apexes of the four added tetrahedra, which is a third critical state in the chemistry of evolution of Nature.

Thus the unit configuration of an 'universal wave' is one in which the first starting state O is Oneness of One which progressively associates a second till both are in equilibrium in form of a first tetrahedron under a second critical state, and changes under a third critical state to a tetrahedral multiplicity which can be termed physically as formation of matter with division of the total energy gradually from a state of Oneness to a state of many and viceversa. This is a process of transfer of Oneness state of Potential energy to a distributive state of severalty of Potential energy through action of kinetic energy and a process of distribution of energy and generated matter,

The Law governing the development of evolutionary wave in a square space of ontinuum of energy shell in four directions in a place has been given by Dr. Chakravarty s $A^2 - (4. M + 4 M^2) = 1$, or $A^2 = (1 + 4M + 4M^2) = (1+2M)^2$, in which A represents vhole squares and M (matter) associated ones square units. Also as sum total of hese respective intensities in the centinuum will be one, hence $1/A^2 + 4M/A^2 + 4M^2/A^2 = 1$ also. Here the intensity variations in the different phases in the phase combination n phnomenal manifestation of Nature will obey this Law, whether it is a photon radiation), atom phase combination or as liquid/solid phase combination, or numerioal ombination of phases.

The above equation shows when M or matter is nil, $1/A^2 = 1$, or $A^2 = 1$, or whole square $A = 1$; that is superintensified energy space on continuum is in an abstract state. When matter M increases, as towards the boundary of the energy shell, progressively at 1 2 3 .. to infinity, the intensity of eherg diminishes as 1/9, 1/25, 1/49 progressively. Dr. Chakravarty has shown that space supported matter phase decreases in intensity as 4/9, 8/25, 12/49 ... ..., and the condensed or position oriented matter phase in the energy shell system increases in intensity as 4/9, 15/25, 3/49 ... series. The sum total of the three intensities at any stage is $= \mathbf{1}$, an abstract state.

The nature of development of atoms of elements in the dispersed state of energy in the Universe, follows a periodic system that follows the $(2M)^2$ mode of square development, where the innermost orbital consists of 4 square units (2, 2), second orbital consists of **12** square units (6, 6) third 20 square units (10, 10), fourth 28 square units (14, 14) and so on. In the progressive evolution of elementary matter the atoms should follows these sequences. But there is a point for consideration whether the prograssive development of elementary matter atoms in their evolution follow the order of filling the orbits in sequences or in terms of their atomic numbers as in natural manifestation and if there is any relation between the two to maintain a state of equilibrium of the system in the natural phenomenon.

Quantum Electrodynamics
AND
Speed Greater Than Light

By

U. P. MULLICK*

Continued from Previous Issue

Speed Greater than light

Charged nutrino mass $m_n = {}^{\cdot}0001345$ mu (this is not neutral neutrino).

The nutrino has energy and mass less than a photon of light. The released energy of a photon of light is about 2.6 mev, and its mass is ·0028 mu.

Mass of a nutrino is ·0001345 mu, and its energy is 931 × ·0001345 mu=·125 mev. (actually, ·1252195 mev)

Mass of a monon is ·00001345 mu, and its energy is 931×.00001345 mu=·0125 mev

Adapting from formula $e=mc^2$,

for photon 2.6 mev=.0028 mu$\times c^2$,

or $c^2 = \frac{2.6}{.0028} = 928.7$, say 929, or

$c=30.5$

For nutrino $e_n = .125$ mev$=.0001345\ c_n{}^2$

or $c_n{}^2 = \frac{.125}{.0001345} = 929$

or $c_n = 30\ 5$

For monon $e_{mo} = .0125$ mev

$=.00001345\ c_{mo}{}^2$

or $c_{mo}{}^2 = \frac{{}^{\cdot}0125}{.00001345} = 929$

or $c_{mo} = 30{\cdot}5$

*Lecture deliveredon August 11 & 15 1978 at the India Society of Engineers, Science Hall.

Hence the speed of motion of monon or nutrino is the same as that of a photon, which means that there is no speed greater than the speed of light, confirming the Einsteinian concept.

But the speed c, c_n, c_{mo} relate to speed from radiation pressure P_R, and it is shown that $c=c_n=c_{mo}$.

Conditions are however different when gravitational force on the quantum of energy is taken into consideration.

The equation for total force covering radiation pressure and force of gravity, gives,

Total force on quantum of energy

$$p=p_R \pm \frac{M_o M_1}{D^2} \cdot g$$

where

P_R=radiation pressure or force
M_o =Mass at source of energy
M_1 =Mass at shell of the energy system
D=distance of source from shell.

Energy behaviour subject to gravitational force in an elastic shell, is examined below.

Case 1, Full energy at source, Nil at shell $d=0$

Case 2, 7/8th energy at source, 1/8th at shell, $d_1 = 1/8$D

Case 3, 6/8th energy at source,

2/8th at shell, $d_2 = 1/4D$

Case 4, 5/8th energy at source,
3/8th at shell, $d_3 = 3/8D$

Case 5, 4/8th energy at source,
4/8th at shell, $d_4 = 4/8D$

Case 6, 3/8th energy at source,
5/8th at shell, $d_5 = 5/8D$

Case 7, 2/8th energy at source,
6/8th at shell, $d_6 = 6/8D$

Case 8, 1/8th energy at source,
7/8th at shell, $d_7 = 7/8D$

Case 9, Nil energy at source,
Full at shell, $d_8 = D$

For case 1, $P = P_R + F_g$

$$= mc^2 - \frac{M_0 M_1}{d^2} g$$

$$= mc^2 \text{, where}$$

$M_1 = 0$, $d = 0$. Hence $\frac{P}{m} = c^2$

For case 2, $P = mc^2 - \frac{M_0 M_1}{d^2{}_1} g$

$$= mc^2 - \frac{7/8\ \mathrm{M} \times 1/8\ \mathrm{M}}{(1/8D)^2} .g$$

$$mc^2 - g.\ 7\frac{M^2}{D^2}$$

$$\text{or } P + 7g.\ \frac{M^2}{D^2} = mc^2 .$$

$$\text{or } \frac{P}{m} + 7g.\frac{M^2}{mD^2} = c_1{}^2 \quad \text{where } c = c_1$$

For case 3, $P = mc^2 \pm \frac{M_0 M_1}{d_2{}^2} g$

$$= mc^2 \pm \frac{\frac{3}{4}M \times \frac{1}{4}M}{\left(\frac{D}{4}\right)^2} g$$

$$= mc^2 \pm 3g\frac{M^2}{D^2}$$

$$\text{or } P + 3g\frac{M^2}{D^2} = mc^2$$

$$\text{or } \frac{P}{m} + 3g\frac{M^2}{mD^2} = c_2{}^2 \quad \text{where } c = c_2$$

For case 4, $P = mc^2 - \frac{M_0 M_1}{d_3{}^2} g$

$$= mc^2 - \frac{M\frac{5}{8} \times \frac{3}{8}M}{(\frac{3}{8}D)^2} g$$

$$= mc^2 - \tfrac{5}{3}\, g\frac{M^2}{D^2}$$

$$\text{or } P + 1\tfrac{2}{3}\, g\frac{M^2}{D^2} = mc^2 \text{ ;}$$

$$\text{or } \frac{P}{m} + 1\tfrac{2}{3}g\frac{M^2}{mD^2} = c_3{}^2 \text{, where } c = c_3$$

For case 5, $P = mc^2 \pm \frac{\frac{1}{2}M \times \frac{1}{2}M}{(\frac{4}{8}D)^2} g$

$$= mc^2 \pm \frac{\frac{1}{4}M^2}{\left(\frac{D}{2}\right)^2}$$

$$= mc^2 \pm g\frac{M^2}{D^2}$$

$$\text{or } P + g\frac{M^2}{D^2} = mc^2$$

$$\text{or } \frac{p}{m} + g\frac{M^2}{mD^2} = c_4{}^2 \text{, where } c = c$$

For case 6, $P = mc^2 + \frac{\frac{3}{8}M \times \frac{5}{8}M}{(\frac{5}{8}D)^2}$, g

$$= mc^2 + \frac{\frac{15}{64}M^2}{\frac{25}{64}D^2}$$

$$= mc^2 + \tfrac{3}{5}g\frac{M^2}{D^2}$$

$$\text{or } \frac{P}{m} - \tfrac{3}{5}g\frac{M^2}{mD^2} = C_5{}^2,$$

where $c = c_5$

For case 7, $P = mc^2 + \dfrac{\frac{2}{8}M \times \frac{6}{8}M}{(\frac{6}{8}D)^2}\, g$

$$= mc^2 + \frac{\frac{12}{64}M^2}{\frac{36}{64}D^2} . g$$

$$= mc^2 + \tfrac{1}{3} g . \frac{M^2}{D^2}$$

$$\text{or} \quad \frac{P}{m} - \tfrac{1}{3}\, g\, \frac{M^2}{mD^2} = C_6{}^2 ,$$

where $c = c_6$

For case 8, $P = mc^2 + \dfrac{\frac{1}{8}M \times \frac{7}{8}M}{(\frac{7}{8}D)^2} . g$

$$= mc^2 + \frac{\frac{7}{64}M^2}{\frac{49}{64}D^2} . g$$

$$= mc^2 + \tfrac{1}{7}\, g\, \frac{M^2}{D^2}$$

$$\text{or} \quad \frac{P}{m} - \tfrac{1}{7}\, g\, \frac{M^2}{mD^2} = c_7{}^2 ,$$

where $c = c_7$

For case 9. when all the energy is at the shell,

$$P = mc^2 + \frac{M_0 \ M_1}{D^2} . g = mc^2$$

where $M_0 = 0$, $D =$ infinity,

or $\dfrac{p}{m} = c_8{}^2$, where $c = c_8$

If the additional effect of speed due to gravitational force that the quantum is subjected to as soon as it leaves the source, and journeys to shell limit, be taken as

$\dfrac{M_0 M_1}{D^2} . \times g = P_x$, then the variation in force, and consequently the variation in speed can be represented as :

$$P_x = \frac{M_0 M_1}{D^2} . \times xg = mc_x{}^2 ,$$

where c_x is the variation in speed,

$$\text{or} \quad c_x{}^2 = \frac{M_0 M_1}{mD^2} . \times xg$$

where $x =$ a variable of g.

$$\text{and } x_1 = g . \frac{M_e M_1}{mD^2} = \text{a constant}$$

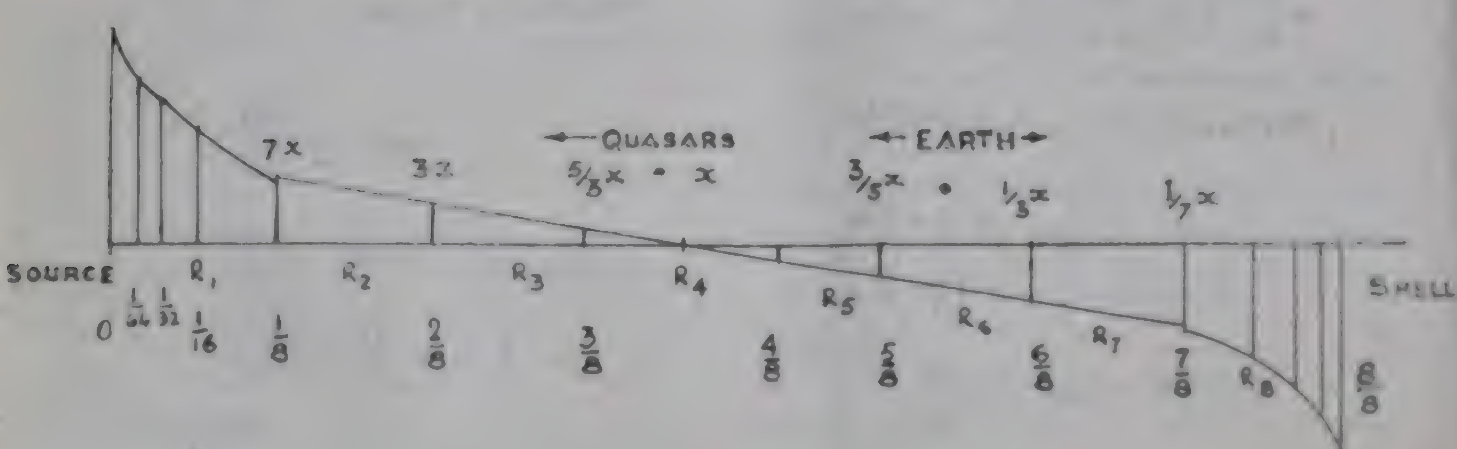
Then starting from source, the value of c_x becomes every 1/8 lap of the journey from seurce to shell boundary as under.

Source : 0,7, 3, 5/3, 1/, 3/5, 1/3, 1/7,0 at shell

If we now divide the region D into 8 Regions, R1, R2, R3, R4, R5, R6, R7, R8 from source to shell, and plot the Regions against the variable values of x,

then at 1/16D distance from source

$$P = mc^2 - \frac{15/16Mx\ 1/16M}{(D/16)^2} . g$$



$$=mc^2 - 15g.\frac{M^2}{D^2}, \text{ or } \frac{P}{m} + 15g.\frac{M^2}{mD^2} = c^2$$

That is value of $x=15$

At a distance 1/32D from source

$$P = mc^2 - \frac{31/32Mx\ 1/32M}{(D/32)^2}.g$$

$$= mc^2 - 31\ g.\frac{M^2}{D^2}$$

$$\text{or } P/m + 31g.\frac{M^2}{mD^2} = c^2$$

That is the value of $x=31$

At a distance of 1/64D from source

$$P = mc^2 - \frac{\frac{63}{64}Mx\ \frac{1}{64}M}{\left(\frac{D}{64}\right)^2}.g$$

$$= mc^2 - 63g\ \frac{M^2}{D^2}$$

$$\text{or } \frac{P}{m} + 63g\ \frac{M^2}{mD^2} = c^2$$

That is, value of $x=63$

At a distance of $\frac{1}{128}$ D from source

$$p = mc^2 - \frac{\frac{127}{128}Mx \times \frac{1}{128}M}{\left(\frac{D}{128}\right)^2}.g$$

$$= mc^2 - 127g.\ \frac{M^2}{D^2}$$

$$\text{or } \frac{P}{m} + 127g.\ \frac{M^2}{mD^2} = c^2$$

That is, value of $x=127$

The progress in rise and fall in speed of light is therefore :

Distance from souree : 0, $\frac{1}{128}$ D, $\frac{1}{64}$ D, $\frac{1}{32}$ D, $\frac{1}{16}$ D, $\frac{1}{8}$ D, $\frac{2}{8}$ D, $\frac{3}{8}$ D, $\frac{4}{8}$ D, $\frac{5}{8}$ D, $\frac{6}{8}$ D, $\frac{7}{8}$ D, $\frac{15}{16}$ D, $\frac{31}{32}$ D, $\frac{63}{64}$ D, $\frac{127}{128}$ D, D

Variation in Square of speed in terms of x is :

$x=0$, 127. 63, 31, 15, 7, 3, 5/3., 1, 3/5, 1/3, 1/7, 1/15, 1/31, 1/63, 1/127.

At 1/128. D from source the speed of light is therefore explosively high over normal observable at earth.

This indicates several things :

FIRSTLY, There is automatic explosion of energy and speed at source as a start to motion of the quanta, resulting in speed higher than normal observable speed of light : and at near end of journey there is an automatic implosion of energy and speed, as an end to the motion of quantum, resulting in speed lower than observed.speed of light, and regaining of normal speed after implosion. through explosion.

SECONDLY, there is an area very close to the source where there is a great deal of commotion of energy particles, energy mass lumps, due to the movement and explosion at near source, and implosion and explosion at near shell boundary, also occurs.

THIRDLY, the gravitational force which is matched at source, and nil at shell boundary, becomes extremely high with 127g at 1/128 D distance from source, and equally low at shell boundary. The very high gravitational force at source being unmatched by the total energy force at the source, kinetic energy is formed, and with release with the latter with mass formed, radiation energy is ejected along with massive energy balls. The lowering of the gravitational force results in loosening and expansion of the lumps of of the energy balls which gradually flow out towards the shell. The balls change to starry masses that change colour with slowing down of speed of motion. The temperature varies from infinity at source to nil at shell, subject to the implosive and explosive effects.

FOURTHLY, the rate of speed of light and quantum energy being explosively high at near the source due to gravitational force coming into play, time is telescoped in at an accelerating rate towards the source, and telescoped out near the shell boundary. This results in possibility of our seeing events near the source at near the same time as the event is happening, and of events near the shell boundary, we have no possibility of seeing at all.

This means that while very strong X-rays from the 'White Hole' near the source reach us before time, close on when they start, the long radio waves nearer the shell do not reach us at all.

FIFTHLY, As radiation pressure acting outwards, and gravitational pressure acting inwards are in the same axial line of motion, but in opposite directions, P being higher and infinite near the source, the resultant velocity and force is not infinite, and thus causes settling down of matter in balls near the source, subject to high temperature and high activity. Matter is thus born near the source, which flows out from the source slowly with reducing velocity and reducing speed of light, as the gravitational force loosens.

SIXTHLY, Matter is the product of interaction of gravitational force with total energy and the velocities of Radiant energy and gravitational force are also matched at source. With unmatching of the forces, velocity of motion increases first, and kinetic energy increases. As for constant force, mass is inversely related to the square of the speed of motion, the velocity and consequently gravitational force control the growth of mass. Similarly speed of motion is also controlled by the gravitational force.

The effect of gravitational force on speed, mass and energy is given by the equation.

$$mc^2 = p \pm xg.\frac{M^2}{D^2},$$

where x=a variable.

Taking x_1 =a constant

$$= g.\frac{M^2}{D^2}$$

We have $mc^2 = p \pm x.x_1$

or $c^2 = \frac{p \pm x.x_1}{m}$. Value of x increases to infinity (positive) when quantum approaches the source, and to zero when it approaches border of the shell.

Value of $m = \frac{p \pm x\,x_1}{c^2}$ is practically nil when both x and c are infinite

SEVENTHLY, when $p = x.g\frac{M^2}{D^2}$,

$$p - x.g\frac{M^2}{D^2} \text{ is nil}$$

or $mc^2 = 0$.

Hence with c infinite, $m = 0$

This means at pin point source total energy force is equal and opposite to the gravitational force, both being infinite, and mass is nil.

Hence it is inferred that it is the gravitational force on matter that changes its potential energy into kinetic energy, or its dilution changes potential energy to kinetic energy.

The heavy mass of the sun and the still heavier mass in the centre of large galaxies like M-87 are due to the fact that these masses are not the pin point mass of the centre, where there is no mass but energy But due to the fact that considerable area surrounding the pin point centre is taken in calculating the mass, the area of conversion to kinetic energy, and birth and heaviest growth of mass is large. For value of x=infinity, value of mass is very high, as well the gravitational force, under equation

$$m = \frac{p \pm x.x_1}{c^2}$$

Thus mass is born not at the pin point source, but in area immediately surrounding it and adjacent to it, due to unmatching of total force with gravitational force. As soon as mass is born, it takes shape in bigger shape due to agglomeration under massive gravitational force, turning into very hot large gaseous balls, whose movements are largely influenced by the gravitational force near the 'White Holes'.

EIGHTHLY, All large sources of energy in the universe can be expected to have a region for birth and acute activity of massive matter near the pin point source. Similarly 'Black Holes' are areas near the shell border, where matter and energy of low temperature are sucked in and exploded back and dispersed in fine state, prior to return journey of matter and energy.

NINTHLY, if the entire distance D, journey from pin point source to shell boundary, is divided into 8 Regions beginning with R_1 from the pin point source, then the quasars presently may be expected to be in Region 4 and the solar system in Region 6, and the entire length D can be classified as under :

Region 1	Origin and growth of matter
Region 2	Growth of gaseous balls
Region 3	Origin of quasars
Region 4	Region of quasars and growing nebulae
Region 5	Region of young nebulae
Region 6	Region of starry and ageing nebulae.
Region 7	Region of cold and dark nebulae
Region 8	Region of disintegration and fine dispersal of matter.

Quantum behaviour from Region 4 to Region 6 of the Universe.

From the classification of the Regions o Universe it will be seen that the quasars i Region 4 will be about 2 Regions distanc from the Earth in Region 6. If the circum ference of the Universe be taken at 500,00 million light years, then the distance o on Region will be about 10 billion light year

if the Universe is fully expanded, and 5 billion light years if the present stage is half way through on the return journey of contraction. The ageing quasars changing to young nebulae with dense mass at centre will be close to the near border of Region 5, about half a Region from earth in middle of Region 6, and will therefore be 2.5 billions L. Y. or less away from earth.

From the classification of the Regions of the Universe it is seen that the square of the speed of light is on the average affected by x changing to $1\frac{1}{3}$ in Region 4, and to $\frac{1}{3}$ in Region 6. The difference is 1. Hence the square of the speed of light c^2 is affected bygravitation by a value $\frac{1}{3}x_1$ increasing to $\frac{4}{3}x_1$ that is by a full $1x_1$ increase over that at Earth in Region. 6

If it is contraction stage, which it is believed we are in, then the quasars are relativistically receding from earth towards source, and the speed of light from same is also above normal value of c. In the net result they may appear to be more or less stationary or slowly moving away with reference to earth, and the quasars from blue turning white.

Against the above, objects in Region 7, where the invisible nebulae and Radio stars are mostly situated, for them earth will normally be speeding away from them to wards the source. To this is added the relativistic slowing down of speed of light by $\frac{1}{3}x_1$ to $1/7x_1$ Hence the nebulae in Region 7 will relativistically appear to move away slower than normal. Radio waves from Region 7 will reach Region 6 at a much slower rate, hence the wave band will change.

This relativistic increase in wave length of radio waves will subject them to more interruptions from intervening nebular matter and space debris on the way.

The same thing may also be said of the nebulae in Region 6 (of earth's) on side of earth towards equator or shell, on which side red stars should be more prolific, and radio waves more noticeable.

On the side of the earth in Region 6 the stars and nebulae will appear to fly away at a lesser speed than the young nebulae and quasars in Region 4. But the relativistic increase in speed of quasars will be offset by the additional relativistic speed of light, with the result that they will appear to move away slower than normally expected, if not stationary or even moving towards the earth.

However stars in Region 6 (earth's) near earth on a line almost transverse to the axis of motion of earth to source, will appear relativistically to approach the earth, instead of flying away, due to the contraction of space, and there will be blue shift in spectrum. Andromeda is known to have blue shift instead of red shift.

Energy Balance at Source

Investigation of the equation p=e

$$=mc^2 \pm g.\frac{M_0 M_1}{D^2}$$

shows that where D=nd, and where n= ∝ (infinity),

$$D=(n=\propto)\ d \qquad \text{or } d=\frac{D}{(n=\propto)}$$

The value of gravitational force F_g then becomes

$$F_g = \frac{\dfrac{(\overline{n=\alpha}-1)M}{(n=\alpha)} \times \dfrac{1\ M}{(n=\alpha.g)}}{\left(\dfrac{D}{\overline{n=\alpha}}\right)^2}$$

$$=(\overline{n=\alpha}-1)\ g.\ \frac{M^2}{D^2} \qquad (1)$$

The force equation gives

$$e=mc^2-(\overline{n=\alpha}-1).\ g.\ \frac{M^2}{D^2} \qquad (2)$$

$$=mc^2-(\overline{n=\alpha}-1).\ g, \qquad (3)$$

where M and D are infinite.

This p=c is the driving force on the quantum of energy, which at source is p (quantum energy or radiation pressure) $=mc^2$ —near infinite gravitational force F_g. Radiation pressure on the quantum has therefore to be infinite near the source. m being infinitesimally small, c^2 or c is therefore near infinite.

The unmatching equation for energy, therefore, at an infinitely small space division dD or dnd close to the pin point source. and subject to infinite speed against near-infinite gravitational force is equation 2.

Here the total gravitational force is less than the total energy force, leading to radiation of energy and movement of quanta of energy.

Integrating equation 2,

$$\int P=\int e=\int mc^2 -$$

$$\int (\overline{n=\alpha}-1)\ g.\ \frac{M^2}{D^2}$$

or total driving force or Radiation force

$$=p_D=E-(\overline{n=\alpha-1}).G.\ \frac{M^2}{D^2} \qquad (4)$$

where E=total energy forcc

and G=total gravitational force

The matching equation for energy for inside the pin point source is :

Firstly. $F_g = G$

$$=\frac{\dfrac{n=\alpha}{\overline{n+1=\alpha}}.\ M\times\dfrac{1}{\overline{n+1=\alpha}}.\ M}{\left(\dfrac{D}{\overline{n+1=\alpha}}\right)^2}.g$$

$$=(n=\alpha).\ G.\ (\alpha)$$

where M is infinite and D=0

Hence total energy force matching equation at source is :

$$P_D=P\alpha-(n=\alpha).\ G\alpha=0$$

where P=E=infinity

and G=infiinity.

The entire energy at pin point source with infinite speed held in check, and infinite mass converted into infinite energy, is held in check by infinite gravitational force, converting the total energy into potential energy.

Vortex at Source

The flow of newly created kinetic energy mass from the source outwards is considered through a vortex orifice conical shaped wide inside and the narrow vortex end or orifice pointing outwards. The release of mass of infinitely high temperature and energy is considered to be due to the pressure difference created by the total energy of the sys-

tem originally in potential state at pin point source expanding at the rate of dn/dt. At distance dn from the pin point, lowering of temperature is in time dt, which initiates the first conversion to kinetic energy opposed to near infinite gravitational force, leading to conversion of energy and creation of mass.

The pin point source expands with creation of massive mass of kinetic energy particles or quanta, which exert pressure against the inward directed gravitational force, which creates a vortex orifice through which is ejected first the infinitaly high speed Radiation energy (kinetic) mass in a long trail. The narrow orifice expands, under the initial pressure of jet like ejection of matter and energy and with release of pressure inside the source, larger denser kinetic energy masses are ejected through the orifice at value of c^2 at near infinite. The heavy masses however, coming out of the jet opening at very high pressure, 'freezes' at very high temperature to balls of gaseous energy matter under near infinite gravitational force just outside the vortex. The gaseous balls are held captive by the high gravitational force of the source within an arc angle of 0 to 15 seconds probably, surrounding the source.

The spin motion of the balls, and hence of all energy mass comprising the balls may be derived from the vortex action, when the kinetic energy mass comes out of the vortex orifice.

Thus the result is, the energy of the source is converted to kinetic energy mass with initial infinite speed of motion, and which flows out from the source, through the vortex orifice, first in long jet trails, when pressure is very high, and then in shape of balls of gaseous energy masses, and finally when there is further reduction of energy pressure inside the expanded source, the flow out of energy mass, and the process of formation of balls of energy mass will slow down.

The balls of energy-masses (on universe scale) gradually get slowly loosened from the loesening grip of the initially near infinite gravitational force at the source as they flow outwards in expanding orderly formation. This continues with the expansion of the energy shell system, and lowering of the gravitational force with increasing distance of the balls from the source.

The dense balls of energy form gradually into young quasars, and then into quasars in an expanding space (or continuum) of the energy shell in Region 4. The density of energy mass per unit area of shell falls, the volumes of quasar balls increase, till they are changed successively to growing nebulae in Region 5, and to starry and ageing nebulae in Region 6 respectively, along with slow down of speed of motion and gravitational force. The flow operation is reverse in the contraction stage of the shell.

Inside the source of energy, the equation of force is :

P_R total kinetic Radiation pressure

$$= E\alpha - (x = \alpha). x_1 = 0$$

The value of P_R increases, as value of $x.x_1$ diminishes, that is as gravitational force diminishes with the energy mass moving outwards in its journey to shell border.

As the value of total energy E, initially E, also diminishes in the source with conversion of energy to kinetic energy mass, the value of mc^2 also changes, mass increasing and speed of Radiation and light falling towards the shell border limit of cxpansion.

The energy equation for energy at next $\frac{dn}{dD} = \frac{dn}{dnd}$ distance from pin point source for jet action is given by

$$P_R = \propto \left(1 - \frac{dn}{dnD}\right) - (x = \propto)\left(1 - \frac{dn}{dnD}\right) . x_1$$

At this pressure the Radiation energy comes out of the vortex orifice in a jet stream.

As internal pressure further reduces at orifice, the equation of pressure for energy ball formation is : (as previous stated)

$$P_R = mc^2 = E\propto \left(1 - \frac{dn}{dD}\right) - \left[x = \propto \left(1 - y . \frac{dn}{dnD}\right)\right] . x_1$$

where y is a functios of distance covered within 0 to 15 arc seconds from the source.

It is also seen that whether at the source, or on the way to shell border, or at the border, the gravitational force (resultant gravitational force) is related to energy and mass. Hence for total conservational Laws for energy and mass, there is also conservation Law for total gravitational force in an Universe system. and the quantum of energy and mass is subject to all the three conservation Laws.

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GENERAL THEORY

The following conclusions are arrived at :

1. A quantum of energy has its own electromagnetic field
2. A quantum of energy travels in any direction in space in spiral motion along its line of motion.
3. Quanta of energy from a single source travel in any direction in concentric spiral motions, S pin rates of smaller diameter are associated with higher speeds of motion and vice versa.
4. Charged particles like nutrinos with 1/5th the mass of excitation energy of hydrogen atom, and monons having 1/9th mass of a nutrino, also travel in spiral motion with spin diameter smaller than ultraviolet rays
5. Penetrating power of a quantum of energy is proportional to the speed of impact, and inversely proportional to the density of the medium. It is also proportional to the mean free path in the medium.
6. A quantum of energy has an acceleration towards its axis of motion, which creates a tendcncy to shorten the diameter of the spin, and hence the wave length, and hence to raise the energy to a higher state.
7. Spin motion of a quantum of energy is a continuous motion, but creates a sense of apparent jumps which are

proportional to half the wave length.

8. A quantum of energy of higher state with higher speed passing in spiral spin by the side of a quantum of lower state, through interaction of electromagnetic fields, pulls up the quantum of lower state, raising its speed of motion, and causes bunching of colours. The relative speed difference is reduced, leading to diffraction of light colours, whose duration is proportional to the relative speed of motion of the quanta.

9. Colour of quantum mass changes with speed of motion, and energy state. It changes from white to blue, to yellow, red and black with change in speed of motion in a reducing gravitational field, and opposite way in an increasing gravitational field.

10. Temperature of a quantum of energy changes from higher to lower level with reducing speed of motion in a reducing gravitational field and vice versa.

11. Total pressure or thrust on a quantum of energy in motion, is the radiation pressure plus / minus the gravitational force for an energy shell system.

12. For a quantum of energy travelling outwards in a expanding energy shell, at extreme limit of expansion the force and speed due to gravity is nil, and the speed of motion due to radiation pressure remains, which rebounds at the shell, and contraction starts

13. The transverse geavitational force between adjoining quanta of energy helps the process of contraction.

14. For two successive quanta of energy travelling in a line towards the shell in an expanding elastic energy shell system, the gap between the successive quanta will close up for a gravitational force reducing towards the shell boundary. Colour will change from blue to red and black.

The gap between successive quanta in a line moving towards the source of energy will increase for a contracting elastic shell with gravitational force reducing towards shell boundary. Colour will change from shell side black to red to blue.

15. The gravitational field strength reduces towards the shell boundary along with reducing speed of motion towards shell boundary, and increases towards the source with increasing speed of motion towards the source.

16 The density of a quantum of energy in motion in an elastic energy shell system, and towards the shell, increases along the radial direction with the progress of motion to wards the shell boundary, and vice versa.

17. Matter and energy range at the shell boundary like a sieve, in gaps and

dots, with weak electromagnetic field between the two consecutive dots of energy.

18. A quantam of cnergy travelling in concentric spiral motion, and lying away from the axis of motion, is affected by a time lag, which is proportional to the distance of the quantum from the central axis of motion.

19. Total incident energy of a quantum is the sum of the reflected energy, refracted snergy and diffracted and dissipated energies of the quantum.

20. For reflected energy of a quantum, the mean free path is nil. The incident energy pressure builds up a back pressure, and the reflected energy particle moves away on reflection at its speed of incidence.

For refracted energy of the quantum of coloured energy the mean free path of ultraviolet energy is longer than for red and infra red energy rays, which leads to a differentiation of the mean free paths and separation of the colour rays. Change in density also affects the mean free path for the incident energy, and changes the speed and the direction of motion.

21. Energy flowing from higher temperature level to lower temperature level behaves much like the diffusion of gases. The velocity $\overline{c}$ of diffusib.lity of energy to plane of low tempatarure level, is dependent on the radiation and gravitational forces driving the quantum, but not upon the densities of the medium.

22. The Universe border is an open border which can allow the speed of diffusibility $\overline{c}$ to create a flow of energy from outside the border to inside, and vice versa, subject to the strength of the electro-magnetic field. in the interstices, inside and outside.
(Chap. 15)

23. There is no speed greater than that of light. But the speed of light itself is variable. It is higher towards the source of energy of the system, over the normal observed speed of light, and lower towards the shell boundary, due to the force of gravity diminishing from source to shell boundary.

24. For an Universe system, the force of gravity tends to be infinite towards the source of energy, and nil towards the shell boundary.

25. Gravitational force affects the speed of motion of a quantum of energy, radiation energy and light, raising the speed of same towards the source, and diminishing same towards the shell boundary.

26. Speed of light being different at the position ot the quasar masses than at Earth, the relativistic speed difference affects the visual timing of light as regards the events observed, as regards light reaching

from quasars to the point of observation in the solar system at earth

27. Energy balance at source is first between total energy and gravitational force, subsequently between converted kinetic energy and balance of total energy on one hand, and gravitational force on the other.

28. Energy per unit area of space (or continuum shell) diminishes after ejection of energy and matter from the expanding source. So does speed ot motion of quantum energy decrease towards the shell boundary along with gravitational force and mass per unit area / space of the energy shell system.

SPECIAL THEORY

1. The speed of light is not constant, but variable. The speed of light in the Universe is greater or lesser than the known speed of light according to the extent it is influenced by the total gravitational force of the Universe at any place.

   This variability of speed of light is governed by the equation

$$mc^2 = e \pm x.g\frac{M^2}{D^2} = e \pm x.x_1$$

Where x = a variable depending on the total gravitational force at any place.

x_1 = a constant for the Universe depending on the total mass M, and total distance D from source or centre of Universe to shell boundary.

2. The pin point source of energy at centre a of very large elastic energy shell system (or at the poles) of the order of the Universe in only energy without mass.

3. Matching of the total gravitational force with the total energy force of the system at the pin point centre, converts the total energy into potential energy, and unmatching converts it into kinetic energy.

4. The closed area (0 to 15 arc seconds) immediately surrounding the pin point source of energy is the area where total energy force and total gravitational force unmatch, releasing massive kinetic energy, and mass and matter are born.

5. Energy is kinetic. When at bay and matched by gravitational force, it is potential.

6. It is in the closed area that 'White Hole' exists outside the orifice of the source, and here matter takes shape into energy masses. The highest speed of the quanta is reached here, and the quanta gravitate into massive white balls of energy with mass and infinite speed of movement, controlled by no other charged mass except the maximum gravitational force of energy meass surrounding and inside the expandd pin point source. The speed of quanta including radia-

tion and light needs to be and is near-infinite to overcome the almost infinite gravitational force and to release the radition energy force.

It is from here and from similarly modelled large energy systems in the Universe that radiation of energy disperses in a stream, and most power ful X-rays and cosmic rays emerge.

7. Energy is perpetual, with which gravitational force remains matched in one at source. Matter is born not before or with energy, but after unmatching of the total gravitationl force at the source, and release of the kinetic energy and mass in the 'womb' area of the Universe, or of large elastic energy shell systems, to area next to the pin point source.

8. There is total Conservation of Energy and Mass and Gravitational force alike in the Universe system. Gravitational force is closely linked with Energy and Mass, and equally comes under the total Conservation Laws limited to the Universe.

Matter is subject to birth, growth decay and death, or annihilation to nothingness, and rebirth through interchange of energy and mass.

9. Near the boundary of the shell of the Universe are areas (or Black Holes) where mostly colourless or black matter and energy are sucked in and through implosion and explosion, the quanta are subject to dispersal in fine state towards the shell border of expansion, where the slowed down speed of energy and light regain to normal, and force of gravitation is absent.

10. There is essentially no difference in quantum bhaviour for a spherical elastic Universe shell, or for very large elastic energy shell system of the order of the Universe with source at centre and for a spherical ellypsoidal Universe shell system with source at the two opposite poles. Both have reversible continous flow operations of the same kind.

11. The Universe is presently in a stage contraction and not expantion and almost halfway through towards source. All energy and matter are moving towards the source. The quasars are clustering in the different epochs of time and Regions.

Life Testing and Reliability Estimation In Industrial Problem

By
S. K. SINHA*

When we buy a television, a power mower, an airconditioner or any such device, we ask ourself 'how long do we expect the device to perform without a major break-down'? Life testing experiments are designed to measure the average life of a product and answer questions such as 'what is the probability that the item will fail in the time interval (t_o, t_o+t) given that it was functioning at time t_o'?

In a simple life testing experiment a number of items are subjected to test and the data consist of recorded lives of all or some of the items. No matter how efficient the manufacturing process is, one or more failures may occur. This may be due to :

(i) careless planning, substandard equipment and raw materials, lack of proper quality control, etc ;

(ii) random or chance causes. Random failures occur quite unpredictably at random intervals and cannot be eliminated by taking necessary steps at the planning, production or inspection stage ;

(iii) wear-out or fatigue caused by t age-ing of the item.

An item is likely to fail at anytime a hence it is reasonable to assume that life of the item is a random variable wit distribution function of its own, say F If X is the life time of the item, we def $F(t)=P(X\leqslant t)$, the probability that the it fails before time t.

$f(t)=\frac{dF(t)}{dt}$ is known as the probabi density function (pdf) corresponding to distribution function F(t). Other import functions associated with F(t) are the haz rate $\mu(t)$ and the reliability function R We define

$$\mu(t) = \lim_{h\to o} \frac{F(t+h)-F(t)}{h\left\{(1-F(t)\right\}}$$

$$= \frac{f(t)}{1-F(t)} \quad \dots\dots (1)$$

In actuarial and life contingency pr blems $\mu(t)$ is known as the force of mortal

Suppose after a thorough feasibility st you make a highlevel decision to buy expensive machinery and there are a num of brands of the same equipment availa in the market. In these days of inflation tight money you want to be resonably s

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hat your investment would be worth while n the long run. You will naturally ask which brand is most reliable'? We use the erm 'reliable' in defferent contexts in our everyday life—such as reliable friend, eliable source, reliable dealer and so on. As an abstract concept it means something or some one we may count on. But to a consumer, reliability is not an abstract concept. It is a very down-to-earth reality to him.

Reliability of an item is defined as the probability that it will function satisfactorily at least for a specified period of time, say t hours. Many questions we have raised earlier could be answered once we know the mathmatical form of F(t); for example the average life of the product could be defined as the mean of the distribution F(t), i. e. $E(T)=\int t dF(t)$, the hazard rate

$$\mu(t) = \frac{d}{dt}\left\{-\log\left(1-F(t)\right)\right\}$$ and reliability

function $R(t)=P(X\geqslant t)=1-F(t)$.

Example 1. Suppose a sample of 15 new brand of light bulbs is put to test and they burn out after 1,000, 1,200, 1535, 2150, 3508,3619, 4780' 5854, 6,308, 7,652, 8,195, 8730, 9028, 9,118 and 9,615 hours.

Looking at the data a prospective buyer asks 'if I buy a bulb of this brand.

(i) how long is it expected to burn ?

(ii) what is the probability that it will burn at least 5000 hours ?'

Question (i) calls for an estimate of the failure time distribution and the simplest estimate one could think of would be the sample mean

$$\bar{x} = \frac{\text{total burning time}}{\text{total number of bulbs exposed}}$$

For the data of Example 1, we have $x \approx 5486$ hours. To answer (ii) one needs to have some understanding of what is meant by probability.

If there are N mutually exclusive, exhaustive and equally likely cases and n of them are favorable to the occurence of an event A, then the probability of A is defined by $P(A) = \frac{n}{N}$. Clearly probability cannot be negative and nor can it exceed unity, i. e. $0\leqslant P(A)\leqslant 1$,

Suppose you are tossing a pair of dice and you are interested in the probability of obtaining a total of 8 points. Now there are 6 possible points to show up in one die and equivalently 6 possible points in the other. Together they give rise to $6\times 6=36$ mutally exclusive, exhaustive and epually likely cases such as.

(1, 1)	(1, 2)	(1, 3)	(1, 4)	(1, 5)	(1, 6)
(2, 1)	(2, 2)	(2, 3)	(2, 4)	(2, 5)	(2, 6)
(3, 1)	(3, 2)	(3. 3)	(3, 4)	(3, 5)	(3, 6)
(4, 1)	(4, 2)	(4, 3)	(4, 4)	(4, 5)	(4, 6)
(5, 1)	(5, 2)	(5, 3)	(5, 4)	(5, 5)	(5, 6)
(6, 1)	(6, 2)	(6. 3)	(6, 4)	(6, 5)	(6. 6)

where (x, y) represents one die showing point x and the other showing point y.

Let A be the even $x+y = 8$. There are five solutions, viz.,

x	2,	3,	4,	5,	6,
y	6	5	4	3	2.

These are the only mutally exclusive, exhaustive and equally likely cases which satisfy the condition that the sum of the points obtained equals 8. Thus $P(A)=5/36$.

Going back to (ii) to Example I it follows that R(5000) = $P(X \geqslant 5000)$

$$= \frac{\text{No. of bulbs which burnt out 5000 hours or more}}{\text{No of bulbs exposed}}$$

$= 8/15 \approx 0.5333$

3. Note that in answering (i) and (ii) we made no assumption about the underlying failure time distribution F (t) or the corresponding pdf f (t). In life testing research the most widel y used model is the one-parameter exponential distribution

$$f\left(t \mid \sigma\right) = \frac{1}{\sigma} \exp\left(-\frac{t}{\sigma}\right), \quad t > 0,\ \sigma > 0 \qquad \ldots\ldots(2)$$

and using (1) we obtain

$$\mu(t) = \frac{\frac{1}{\sigma} \exp\left(-\frac{t}{\sigma}\right)}{\exp\left[-\frac{t}{\sigma}\right]} = \frac{1}{\sigma},$$

a constant, since

$$i - F(t) = P(X > t) = \frac{1}{\sigma}\int_t \exp\left[-\frac{t}{\sigma}\right] dt$$

$$= \exp\left[-\frac{t}{\sigma}\right].$$

Where the failure rate is more or less constant the exponential distribution would be an adequate choice but not all items stisfy the condition that they do not age. There are several situations where $\mu(t)$ may be increasing or decreasing with time t. Given the data, perhaps the best one can do is to apply some transformation which will support the hypothesis that the transformed observations are exponentially distributed (Draper and Guttman, 1965) or check the assumption of exponentiality by some appropriate statistical test (Epstein, 1960).

The exponential distribution ha several interesting properties. We men a few in the following ;

(i) The distribution is forgetful or 'h no memory'. What it means, however is that if a unit has survived t hours then the probability that it will surviv an additional h hours is exactly the same as the probability of a new item surviviug h honrs.

(ii) If n items are under test *with replacement* and the failure time distributi on is exponential with mean life σ then the 'between failure times' ar independent and exponentially distribu ted with mean life $\frac{\sigma}{n}$. (The term 'with or without replacement' refers to respec tive situations where the items tha fail are or are not replaced by simila new items).

(iii) If n items are put to test *without replecement* under the same failure time distribution as in (ii) and ($X_{(1)}$ $X_{(2)} \ldots X_{(n)}$) are the ordered failure times i.e. $X_{(1)} < X_{(2)} < \ldots < X_{(n)}$ then $Z_1, Z_2, \ldots Z$ are independent exponentially distributed random variables with mean life σ where

$Z_i = (n-i+1)\,[X_{(i)} - X_{(i-1)}]$, $i = 1, 2, \ldots n$; $X_{(0)} = 0$.

4. *Estimation of Parameters.*

Let ($X_1\ X_2, \ldots X_n$) be a sample of n inde pendent observations from a pdf f(x | where the parameter θ is unknown There are a number of accepted princi ples of estimation of θ. We wi consider here what is known

the principle of maximum likelihood due to Fisher (1925). The product $L=\pi_{i=1}^{n} f(x_i / \theta)$ is known as the likelihood function or the likelihood of the sample. The method of maximum likelihood consists in choosing that value of θ which maximizes L, If the range of the distribution is independent of θ the maximum likelihood astimator (mle) $\hat{\theta}$ is the solution (if one exists) of the equation

$$\left.\frac{\partial L}{\partial \theta}\right]_{\theta=\hat{\theta}} -0 \text{ or equivalently}$$

$$\left.\frac{\partial}{\partial \theta}\log L\right\}_{\theta=\hat{\theta}} =0, \text{ and}$$

$$\mathrm{Var}\left\{\hat{\theta}\right\}= -n\left(\int\left\{\frac{\partial^2}{\partial \theta^2}\log f(x \mid \theta)\right\}f(x \mid \theta)dx\right)^{-1}$$

is the variance of the estimator $\hat{\theta}$ The standard deviation or the positive sqauare root of the variance is a measure of precision of the estimator.

Let us suppose that we have a complete sample at our disposal, i. e. n items are put to test and test is terminated after all the items have failed. Let the random failure times $(X_1, X_2, .. X\ )$ be exponentially distributed with pdf

$$f(x \mid \sigma)= \frac{1}{\sigma}\exp\left(-\frac{x}{\sigma}\right), X>0, \sigma>0,$$

and we wish to estimate σ.

y definition $L = \frac{1}{\sigma^n}\exp\left(-\frac{\sum_{1}^{n} x_i}{\sigma}\right)$

$$\frac{\partial}{\partial \sigma}\log L = \frac{-n}{\sigma} + \frac{\sum_{1}^{n} x_i}{\sigma^2}$$

$0 =$ yields the mle $\sigma = \bar{x}$.

After some algebra one obtains

$$\mathrm{Var}\ (\hat{\sigma})-\frac{\sigma^2}{n}.$$

The mle has an important property that if $\hat{\theta}$ is the mle of θ, then any function $g(\hat{\theta})$ is the mle of $g(\theta)$ provided that $g(\theta)$ is fairly well behaved (Zehna), 1966). Therefore the mle of var $(\hat{\theta}) = \frac{\bar{x}^2}{n}$.

The reliability function at any time t is given by $R(t)= P\ (X\geqslant t)$

$$= \frac{1}{\sigma}\int_t^{\infty}\exp\left\{-\frac{x}{\sigma}\right\}dx = \exp\left\{-\frac{t}{\sigma}\right\}.$$

Hence the mle of $R(t) = \exp\left\{-\frac{t}{\hat{\sigma}}\right\}$.

The actual derivation or Var $\left\{\hat{R}(t)\right\}$ is quite complicated and interested readers are referred to Sinha (1972).

Going back to the date of Example 1, we obtain $\hat{\sigma} = 5486$ and $\hat{R}(5000) =$

$$\exp\left\{-\frac{5000}{5486}\right\}\approx 0.4020$$

Note that the mle $\hat{\sigma}$ is the same as the earlier estimator $\bar{x}$; this is because the mle of σ just happens to equal $\bar{x}$ for the exponential model (2). But $\hat{R}(t)$ differs from the simple estimate based on the classical definition of probability.

Thus far we have assumed that under the single—parameter exponential model the probability of failure at the strating time is zero. In many situations one can reasonably assume that the probability of failure up to a certain time μ is zero and there-after the failure time follows the exponential distribution. This implies that the pdf of the failure time X is given by a two-parameter exponential family $f(x/\mu,\sigma)$

$$= \frac{1}{\sigma} \exp\left\{-\frac{x-\mu}{\sigma}\right\},$$

$x \geqslant \mu$, $\sigma > 0$ and $= 0$ elsewhere.

If μ is known, without any loss of generality we may take it to be zero and we are back to a single-parameter exponential distribution. The knowledge of μ may be used to write warranties about the failure-free-time of the item

Let $(X_{(1)} X_{(2)} \ldots X_{(n)})$ be the ordered failure times of the n items under test. The likelihood of the sample is given by

$$L(x_1, x_2 \ldots x_n / \mu, \sigma)$$

$$= \frac{1}{\sigma^n} \exp\left\{-\frac{\sum_1^n (x_i - \mu)}{\sigma}\right\}$$

$x_i \geqslant \mu$, $\sigma > 0$.

For a fixed σ, Max L is attained at μ which minimizes

$\sum_1^n (x_i - \mu)$, $\mu \leqslant x_i$ for all $i = 1, 2, \ldots n$

and hence $\hat{\mu} = x_{(1)}$, the first failure time. Now consider the likelihood function

$$L(x_1, x_2, \ldots x_n / x_{(1)}, \sigma) =$$

$$\frac{1}{\sigma^n} \exp\left\{-\frac{\sum_1^n (x_i - x_{(1)})}{\sigma}\right\}$$

$$\frac{\partial}{\partial\sigma} \log L = \frac{-n}{\sigma} + \frac{\sum_1^n (x_i - x_{(1)})}{\sigma^2}$$

$= 0$ yields $\hat{\sigma} = \bar{x} - x_{(1)}$. Thus $\hat{\mu} = x_{(1)}$ and $\hat{\sigma} = x - x_{(1)}$ are the mle of μ and σ.

Consider the reliability function $R(t) = 1$ $t \leqslant \mu$ and $= \exp\left(\frac{t-\mu}{\sigma}\right)$ $t > \mu$.

The mle is given by $\hat{R}(t) = 1, t \leqslant x_{(1)}$ and $= \exp\left(\frac{t - x_{(1)}}{\bar{x} - x_{(1)}}\right)$, $t > x_{(1)}$

5. Censored Samples

Life testing experiments are often destructive in nature i. e. at the end of the experiment, the items cannot be used again. Thus tests based on complete samples are expensive as well as time consuming. This calls for some kind of restrictions on the design of experiments. The following sampling schemes are commonly used :

i) Failure-censored samples : n items are subjected to test and the test is terminated as soon as a preassigned $r (\leqslant n)$ number of items fail.

ii) Time-censored samples : n items are subjected to test and the test is terminated after a pre-assigned time t_0 hours,

For a single-parameter exponential model specified in (2) we quote the mle of σ for 'with' and 'without replacement' cases.

Let $x_{(r)}$ represent the rth failure item.

Under (i) $$\hat{\sigma}_r = \frac{\sum_1^n x_{(i)} + (n-r)\, x_{(r)}}{r}$$

without replacement and $= \frac{n\, x_{(r)}}{r}$,
with replacement

Under (ii)

$$\left.\begin{array}{l} \hat{\sigma}_{t_o} = \dfrac{\sum_{1}^{n} x_{(i)} + (n-m)\, t_o}{m}, \ m > 0 \\ \text{without replacement, and} = nt_o,\ m = 0. \end{array}\right\}$$

$$\left.\begin{array}{l} \hat{\sigma}_{t_o} = \dfrac{nt_o}{m}, m > 0 \\ \text{and} = nt_o,\ m = 0 \end{array}\right\} \text{with replacement,}$$

where m is the number of failures between $t = o$ and $t = t_o$. Example 2. 50 items were put to test and the test was terminated after the first 15 items failed. The failure times (in hours) were recorded as follows : 80, 120, 130, 144, 210, 280, 360, 418, 520, 680, 800, 890, 950 1,020 and 1,180. Assuming the failure time distribution is exponential with mean life o, estimate σ and the reliability function R (t) at $t = 700$ hours if the items that failed are

i) not replaced,

ii) replaced.

We have $n = 50$, $r = 15$. Under (i)

$$\hat{\sigma}_r = \frac{\sum_{1}^{15} x_{(i)} + (50 - 15)\, x_{(15)}}{15} \approx$$

3272 hours and $\hat{R}(700) = \exp\left(-\frac{700}{3272}\right) \approx$

0. 8074 $\hat{\sigma}_r = \frac{50\, x_{(15)}}{15} \approx 3933$ and

$$\hat{R}(700) = \exp\left(-\frac{700}{3933}\right) \approx 0.8370$$

Example 3. 90 items were tested for 1000 hours and 15 failures were recorded after 80, 102, 190, 280, 386, 485, 550, 690, 720, 780, 825, 880, 930, 960 and 980 hours.

Assuming one-parameter exponential life distribution, estimate the mean life and reliability function at $t = 650$ hours for (i) with and (ii) without replacement cases.

We have $n = 90$, $m = 15$, $t_o = 1000$.

Under (i) $\hat{\sigma}_{t_o} \ \frac{nt_o}{m} = 6000$ and

$$\hat{R}(650) = \exp\left(-\frac{650}{6000}\right) \approx 0.8973$$

$$\hat{\sigma}_{t_o} = \frac{\sum_{1}^{15} x_{(i)} + 1000\,(90-15)}{15} \approx 5589 \text{ and}$$

$$\hat{R}(650) = \exp\left(-\frac{650}{5589}\right) \approx 0.8902.$$

6. Another impotant model extensively used in life testing problem is known as the Weibull distribution. Weibull (1961) proposed if for the first time in connection with his studies on the strength of material. The Weibull pdf is given by $f(x/\sigma, p) = \frac{p}{\sigma} x^{p-1} \exp\left(-\frac{x}{\sigma}\right)$, p, σ, x 7 0. p and σ are known as the shape and scale parameter.

For fixed σ as p increases, the density→ more and more peaked and symmetric about the mean whereas for-fixed p as σ increase, the density→more and more skew having a long right tail. The distribution function $F(t) = P(x \leqslant t)$

$$= \frac{p}{\sigma}\int_{0}^{t} x^{p-1} \exp\left(-\frac{x^p}{\sigma}\right) dx$$

$= 1 - \exp(-\frac{t^p}{\sigma})$ and hence from (1) we have the hazard rate $\mu(t) = \frac{p}{\sigma} t^{p-1}$.

For $p = 1, \mu(t) = \frac{1}{\sigma}$ which represents the single parameter exponential distribution with mean life σ.

For $p > 1$, $\mu(t)$ is increasing indicating the 'age—ing' effect. With comlete sample $x_1, x_2 \ldots x_n$), the likelihood function

$$L = \frac{p^n}{\sigma^n} \left\{ \prod_{i=1}^{n} x_i^{p-1} \right\} \exp\left(-\sum_1^n \frac{x_i^{\ p}}{\sigma} \right)$$

$$\frac{\partial}{\partial p} \log L = \frac{n}{p} - \frac{\sum_1^n x_i^{\ p} \log x_i}{\sigma} = 0$$

$$\frac{\partial}{\partial \sigma} \log L = \frac{-n}{\sigma} + \frac{\sum_1^n x_i^{\ p}}{\sigma^2} = 0$$

lead to $\hat{\sigma} = \sum \frac{x_i^{\ \hat{p}}}{n}$ ....(3)

and $\frac{1}{\hat{p}} + \frac{\sum_1^n \log x_i}{n}$

$$= \frac{\sum_1^n x_i^{\ \hat{p}} \log x_i}{\sum_1^n x_i^{\ \hat{p}}} \quad \ldots\ldots\ldots\ldots (4)$$

where $(\hat{p}, \hat{\sigma})$ are solution of (3) and (4). (4) may be solved for $\hat{p}$ by Newton-Raphson or any other suitable iterative method and the value substituted in (3) to obtain $\hat{\sigma}$.

For the mle of (p, σ) with censored samples, readers are referred to Cohen (1965).

7. Although not so widely used as the Exponential and Weibull model. Gamma and Normal models are important distributions in life testing research.

Consider a two-parameter gamma distribution with pdf

$$(fx \,/\, \sigma p) = \frac{1}{\sigma^p \Gamma(p)} \, x^{p-1} \exp\left(-\frac{x}{\sigma}\right),$$

$$x, p, \sigma > 0 \quad \ldots\ldots\ldots\ldots (5)$$

where Γ (p) is the well-known gamma function with parameter p and equals (p—1)! for integral p. Note that for p=1, (5) reduces to the one-parameter exponential pdf (2). In this context both gamma and Weibull are generalization of the exponential distribution.

Unlike the exponential and Weibull, the gamma distribution does not have simple closed mathematical expression for F(t), R(t) or $\mu(t)$. The hazard rate $\mu(t)$ can be shown to be increasing with t indicating an 'age-ing' effect. Gamma distribution has an important and useful property that if $(x_1, x_2, \cdots x_k)$ are independent identically distributed gamma variaties with parameters $(p_1, p_2, \cdots p_k)$ then $\sum_1^k x_i$ is distributed as a gamma with parameter $\sum_1^k p_i$.

Let the failure times $(x_1, x_2, \cdots x_n)$ be distributed as gamma in (5) with parameters p and σ. The likelihood function is given by

$$L = \frac{1}{\sigma^{np}} \frac{1}{[\Gamma(p)]^n} \left(\prod_1^n x_i^{\ p-1} \right) \exp\left(-\frac{\sum_1^n x_i}{\sigma} \right)$$

$$\log L = -n p \log \sigma - n \log \Gamma(p) + (p-1) \sum_1^n \log x_i - \frac{\sum_1^n x_i}{\sigma}$$

$$\frac{\partial}{\partial \sigma} \log L = \frac{-np}{\sigma} + \frac{\sum_{1}^{n} x_i}{\sigma^2},$$

$$\frac{\partial}{\partial p} \log L = -n \log \sigma - n \frac{\partial}{\partial p} \log \Gamma(p) + \sum_{1}^{n} \log x_i$$

f p is known, the mle $\hat{\sigma} = \frac{\sum_{1}^{n} x_i}{n p} = \frac{\bar{x}}{p}$

f p is unknown, $\hat{\sigma} = \frac{\bar{x}}{\hat{p}}$ ... ... (6)

where $\hat{p}$ is the solution of the equation

$$\left[\frac{\partial}{\partial p} \log \Gamma(p)\right]_{p=\hat{p}} - \log p = \frac{\sum_{1}^{n} \log x_i}{n} - \log \bar{x} \quad \text{.. (7)}$$

The equation (7) may be solved for $\hat{p}$ by iteration $\hat{\sigma}$ obtained by substituting in (6).

Consider a normal distribution with parameters (μ, σ^2). The pdf is given by

$$f(x / \mu, \sigma) = \frac{1}{\sqrt{2 \pi \sigma^2}} \exp\left\{-\frac{(x-\mu)^2}{2 \sigma^2}\right\} \quad \sigma > 0, -\infty < \mu < \infty \quad \text{...(8)}$$

μ is the mean and σ^2 is the variance of the distribution.

For simplicity (8) is sometimes represented by $X \approx N(\mu, \sigma^2)$.

Let $(X_1, X_2, \ldots X_n)$ be random failure times distributed as $N(\mu, \sigma^2)$. The likelihood function is given by

$$L = \left(\frac{1}{2 \pi \sigma^2}\right)^{\frac{n}{2}} \exp\left\{-\frac{\sum_{1}^{n}(x_i - \mu)^2}{2 \sigma^2}\right\}$$

$$\log L = \frac{-n}{2} \log 2\pi - \frac{n}{2} \log \sigma^2 - \frac{\sum_{1}^{n}(x_i - \mu)^2}{2 \sigma^2}$$

$$\frac{\partial}{\partial \mu} \log L = \frac{\sum_{1}^{n}(x_i - \mu)}{\sigma^2}$$

$$\frac{\partial}{\partial \sigma^2} \log L = \frac{-n}{2 \sigma^2} + \frac{\sum_{1}^{n}(x_i - \mu)^2}{2 \sigma^4}$$

If μ is known, the mle $\hat{\sigma}^2 = \frac{\sum_{1}^{n}(x_i - \mu)^2}{n}$

If μ is unknown, the mle $\hat{\mu} = \bar{x}$ and $\hat{\sigma}^2 = \frac{\sum_{1}^{n}(x_i - \bar{x})^2}{n}$

The reliability function

$$\begin{aligned} R(t) &= P(X \geqslant t) \\ &= \frac{1}{\sqrt{2 \pi \sigma^2}} \int_{t}^{\infty} \exp\left(-\frac{(x-\mu)^2}{2 \sigma^2}\right) dx \\ &= \frac{1}{\sqrt{2 \pi}} \int_{\frac{t-\mu}{\sigma}}^{\infty} \exp\left(-\frac{z^2}{2}\right) dz \\ &= 1 - \phi\left(\frac{t-\mu}{\sigma}\right) \end{aligned}$$

where $\phi(z) = \frac{1}{\sqrt{2 \pi}} \int_{-\infty}^{z} \exp\left(\frac{-x^2}{2}\right) dx$

and are extensively tabulated for a wide range of values of z. Hence the mle $\hat{R}(t) = 1 - \phi\left(\frac{t - \bar{x}}{\hat{\sigma}}\right)$ when μ and σ are both unknown.

Example 4. 10 items were put to test and the failure times were recorded as follows : 100, 140, 150, 160, 210, 284, 325, 432, 564

and 618 hours. Assuming that failure times follow $N(u, o^2)$, obtain the mle of u, o and $[R(t)]_{t=400}$.

We have $n=10$, $\sum_1^{10} x_i = 2{,}983$,

$\sum_1^{10} x_i^2 = 1\ 194\ 725$. Hence $\hat{\mu} = \bar{x} = 298.3$ hours, $\hat{\sigma} = \sqrt{\frac{\sum_1^{10} (x_i - x^{-2})}{10}}$

$= 174.61$ hours and $\hat{R}(400) = 1 -$

$\phi \left[\frac{400 - 298.3}{174.61}\right] = 1 - \phi(0.5824) = 0.2802.$

For estimation with censored samples from $N(\mu, \sigma^2)$, readers are referred to Gupta (1952) and Plackett (1959).

REFERENCE

1. Cohen, Jr., A.6. (1965), "Maximum likelihood estimation with Weibull distribution based on complete and on censored samples", Technometrics 7, 579—588.
2. Drapper, N. and Guttman, I. (1965), "Transformation of life-test data", Technical Report No. 60, Department of Satistics University of Wisconsin.
3. Epstein, B. (1960), "Test for validity of the assumption that the underlying distribution of life is exponential", Technometrics 2, 83-101 : 167-183.
4. Fisher, R.A. (1925), "Theory of statistical estimation", Proc. Cam. Phil. Soc. 22. 700-725.
5. Gupta, A.K. (1952), "Estimation of the mean and the standard deviation of a normal population from a censored sample", Biometrika 39, 260—273.
6. Plackett, R.L. (1959), "The analysis of life test data, "Technometrics 1, 9—19
7. Sinha, S.K. (1972), "Reliability estimation in life testing in the presence of an outlier observation", Operations Research 20, 888—894.
8. Weibull, W. (1961), "Fatigue testing and analysis of result" ,Ozford pergamon.
9. Zehna, P. W. (1966) , "Invariance of maximum likelihood estimators ", Annals of Mathematical Statistics 66 , 891.

NOTES & NEWS

Pilot Plant for Cardon Block at RRL, Jorhat.

A pilot plant(capacity, 200 kg 1 day) for the production of carbon black has been set up at theRegional Research Labortory (RRL) Jorhat. The laboratory undertook advanced development work on carbon block from Assam coal on behalf of Union Carbon Black Ltd. (UCBL) Gauhati, who have been licensed to commercialize the process. The pilot plant would enable the laboratory to study the various reaction parameters, train the operating Staff for a commercial plant and produce carbon black for UCBL for market study and promotian.

C.S.I.R. in the Service of Rural Society

The Indian National Scientific Documentation Centre (INSDOC), New Delhi, has brought out a document entitled C.S.I.R. in the Service of Rural Society which gives an overview of the activities of theCouncil of Scientific & Industrial Research and its laboratories in the areas relevent to rua development. Enquiries about the publicatio may be addressed to : Technology Utili zation Division, Council of Scientific & Industrial Research, Rafi Marg, Nev Delhi — 110001.

Directory of Testing Facilities

The Indian National Scientific Docume tation Centre (INSDOC), New Delhi, ha taken up the compliation of a Directory c Testing Facilities in India' under th National Information System for Scienc and Technology, (NISSAT Scheme of th Department of Science and Technology Th directory will cover facilities relating to th testing of agricultural and food product Chemicals, drugs & pharmaceuticals, instru ments & appliances, textiles, electrical eng neering, electronics, etc. etc. Institutions an organizations which have such facilities eve if ment for in house use only, may send par ticulars ia this regard in conformity with th questionnaire designed for the purpose Questionnaires may be obtained, on reques from the Scientist - in-charge, Insdoc, Hi Side Road, New Delhi—110012.

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Mr. U. P. Mullick was educated at the Presidency College, Calcutta and Bengal Engineering College, Shibpore obtained B. Sc. (Hons) degree in Physics in 1926 and B. E. in Civil Engineering in 1929 and received Heaton Gold Medal for Civil Engineering Design and Architecture. Mr. Mullick started practice as Consulting Engineer as a Partner of M/s Hope Johnstone & Son in 1933 and how he is the principal of the firm, with extensive all India practice as Consulting Engineer, Architect Valuer, Town Planner and Industrial Consultant.

He contributed National Reports on Planning for EAROPH, and Reports for S. E Asia Economic Commissions (EAROPH and FIHP) on Planning and served on the Council of the EAROPH. Prepard the unofficial Report on 'Habitat' for UN (Vancouvre) Meeting on Planning for India. He made extensive contributions by way of technical papers on the Theory of Metropolitan, Urban and Rural planning and Regional planning, contributing both to the Research section Planning Commission, Government of India, Reserve Bank of India and associated over years with Seminars on Town Planning of Town & Country Planning Institute, Delhi. He prepared the first Master Plan for Greater Calcutta (1960 Bangalore Seminar and on Utilities, Services and Community facilities (Electricity, Water and Drainage etc.) for Greater Calcutta (1961 Madras Seminar), and for Community Development Seminar Hyderabad (1959), in Bombay Seminar for AICP Seminars on towns (1958), and in Housing Seminar (1956) of NBO at New Delhi)

He was elected Associate Member of Institution of Engineers (India in 1942, and Member in 1956,. Elected Member Association of Engineers in 1956 and in its Council since. Elected Member of India Society of Engineers in 1956, become its President in 1966, and its Honorary Fellow since, He was the Founder President and Fellow of Institute of Consulting Engineers since 19[illegible] was elected member of Institution of Welding (London) in 1957. He is the Founder President of India Inter Planetary Society 1963, elected a Fellow of Mining,

letallurgical and Geological Society of India n 1965, elected Member of Royal Society of Heaith (Lond) in 1958, and Fellow in 1965, lected Members of Institution of Surveyors n 1959 elected Member IndianR ocket Soci ety n 1968, Member EAROPH in 1956, Member Institution of Valuers and Fellow 1968, and its Chairman, West Bengal Zone in 1974. He is Founder President and Fellow of Valuers' Institute since 1968. Member New York Academy of Sciences elected in 1960, Member Institution of Industrial Engineers (India) in 1965, President and Founder of Federation of Professional Engineering Institutions of India in 1973.

He is responsible for over 300 Technical and Engineering papers published in various journals in all branches of Engineering and technology and responsible as author for 25 scientific publications papers and books, for 40 literary books, and over 50 philosophical books.

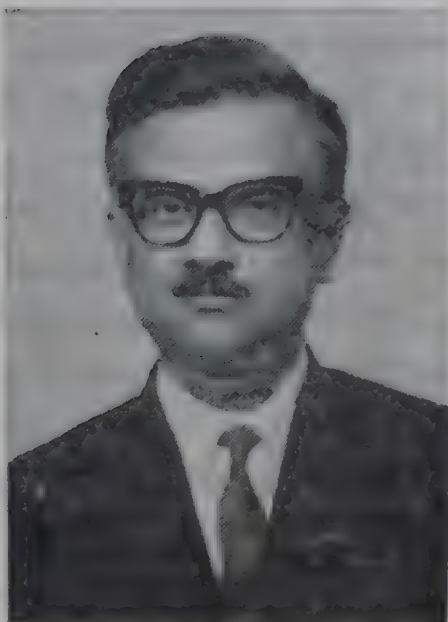
Prof. S. K. Sinha

Prof. Snehest Kumar Sinha Obtained B.A, (Hon) and M.A. degrees from the University of Patna; India, A.M. from the Univerersity of Chicago, M,Sc. (Econ) from London School of Economics, University of London and Ph.D. from the University of London.

Prof. Sinha is teaching undergraduate and graduate Courses in Statistics in Canadian Universities at Assistant Professor, Associate Professor and Full Professor levels since 1959. He has wide experience in research in Industrial Statistics, Reliability Theory, Bayesian Inference and Estimation in the presence of an outlier observation. Published Several papers in National and International Journals of Statistics. Prof Sinha has currently completed one-year assignment, as the Founder and Head of the Department of Statistics and Acting Head of the Department of Mathematics at the University of Ilorin, Ilorin, Nigeria. Presently he is associated with the University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2.

Personal

Dr. RAMANNA MOVES TO DEFENCE MINISTRY



DR. Raja Ramanna, who handed over charge as Director, Bhabha Atomic Research Centre on June 30, 1978 has taken over as Secretary to the Govt. of India, Ministry of Defence, for Defence Research. He is concurrently the Scientific Adviser to the Defence Minister and Director General, Defence Research and Development Organisation.

DR. Ramanna is President of the Indian National Science Academy and a Member of the National Committee on Science and Technology, Vice-President of the Indian Academy of Sciences and a Fellow of the National Academy of Sciences, and the Indian Society of Engineers.

(Nuclear India, July 1978)

Stand by the flood Victims

Main Text of Resolution moved from Chair at the meeting of the Executive Committee of the India Society of Engineers held on September 15, 1978 :

The President and Members of the Executive Committee of India Society of Engineers, on behalf the Society express their deep sorrow at the death of many of our of Countrymen, Women and Children as a result of this current unprecedented flood havoc. A two minutes silence is observed standing in memory of the dead.

The India Society of Engineers express further their deep sympathy with the surviving people striken by the flood and its after math, and resolves that its members be requested to forward their donations freely to the Society earmarked 'The Chief Ministers' Flood Relief Fund' to maximum possible extent in this hour of distress of the flood affected people.

The Society also sympathises deeply for the loss and death of hundreds of domestic cattle due to the devastating flood.

Published by Sri Arup Ratan Bhattacharya from India Society of Engineers, 12-B, Netaji Subhas Road, Calcutta-1 and printed by him from Gupta Printers (P) Ltd., 74/B, Amherst Row, Calcutta-9 (Phone : 35-4262)

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SCIENCE & ENGINEERING

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SCIENTIST AND SCIENTIFIC RESEARCH

In the history of Calcutta University most probably this is for the first time an occasion arises to invite a renowned scientist like prof. M. G. K. Menon to deliver the convocation address. We must appreciate the attitude of the University authorities for this academic approach in inviting an educationist, breaking up the long standing tradition.

The comments and suggestions made by Prof. Menon in course of his convocation address regarding science teaching and research in this country are of immense importance and now it is very high time for us to give a serious thought over this matter.

We can recollect the days, not far off, only 50 years back, when the only discovery of "Raman's effect" made by C. V. Raman brought a Nobel Prize in science to this country. That was the time when scientific talents like Jagadis Chandra Bose, Prafulla Chandra Roy, Satyendra Nath Bose, Meghnad Saha, P. C. Mohalanobis, K. S. Krishnan, J. C. Ghosh made a real contribution to science. Today our scientists are practically doing research for evolving new methods of transfer technology in utilising science for economic and social transformation. It can be assumed that practically no such fundamental research work is going on in our country, because after that golden era no remarkable scientific contribution has been made in India.

The lack of fundamental research is due to the fact that science today has become a major profession. Prof. Menon has rightly remarked "now the scientists are technically competent to be a scientist, though they may not be motivated by the spirit of enquiry that one would have thought as an essential characteristic of scientist of an earlier period; this has resulted in a transformation of the scientific community from one which was entirely built up of people with an inner urge for discovery, to one where a large number employ their technical skill to perform tasks which, with the sheer power of these skills and the efforts put in by large numbers, result in discoveries".

Have we ever thought, why fundamental research work is lacking in our country ? Why science today has become a major profession ? Because the primary goals of research sponsored and financed by the Government are for the use of science to raise

the level of economic activity and improve the quality of social services. The main business of national laboratories are research in aid of technology, and thus economic and social improvement. There are no standards to determine practical relavance or potential usefulness and it is not easy to specify which research projects are necessarily inappropriate. What seemed wrong about much of both fundamental and applied research in our national laboratories was that its potential usefulness was not always clear, it often consisted of desultory probes into disparate subjects.

Today research grants for the Universities are mainly for the invention of appropriate transfer technology of science. So the scientists are interested for quick result oriented research rather than fundamental research. Now the Universities are not meant for the conservation of knowledge, for the application of knowledge, for the discovery of knowledge, for the distribution of knowledge or for the creation of knowledge makers but an industry where graduates, post graduates and doctorates are produced in a commercial scale to suit our industries and research laboratories. What is more tragic that our scientists have lost the essential characteristics of inner urge for discovery and even do not hesitate to express their apathy in going through a fundamental research work apart from their own specialized topic.

It is the primary responsibility of the Universities to take up fundamental research not only for mere academic interest but also for the advancement of science and creation of knowledge makers. So the Uuiversity teachers specially in the branches of science must be competent and capable of handling and guiding fundamental research.

It will be painful if we find the University authorities acting diametrically opposite instead. Hope one has yet to forget the news flashed in the newspaper recently regarding the appointment of Professor in Calcutta University, where a D. Sc. with proven ability of guiding research and published works was denied and a much less qualified Ph. D. with less number of published works was preferred by the Universiy. This is not the only case of Calcutta University but more or less in all Universities in our Country. In any case this sort of activities should be discouraged and vigilence should always be kept to select a really desireable candidate, if required selection procedure can be changed. At the same time science curriculm needs quick modification. This should be prepared in consultation with the renowned scientists of our country and not by the mere educationists at top of the University for their unrealistic experiment.

History of Architecture

By

B. B. JOSHI*

The origin of the art of building is den in the mists of antiquity. Necessity, mother of invention, has compelled ry living creature on the face of earth seek shelter from the intense cold, rching heat and stormy weather. Rabits l rats scoop holes in the ground, birds ld nests, and beasts their lairs.

The pre-historic people also in order to tect themselves from the wild beasts l inclement weather, were forced to take uge in the hollows of the trunks of trees well as in the caves. The wonderful chitecture of the day had its origin in the imitive dwellings, which men made for emselves after deserting the caves. The st dwellings, were only shelters made of ives and branches. Gradually, as men ogrcssed these small huts were substituted more durable structures-crude huts built stone roughly piled upon one another.

esopotamian Architecture.

The real history of Architecture may be aid to have begun in Mesopotamia. It is alled the cradle of mankind. Mesopotaian were the first people in the world, ho made houses of sun-dried bricks from he clay which was abundant in the country, as stone was scarce. Sargon, the king of Assyra-a city in Mesopotamia, built the most wonderful temple in 700 B. C. It was built on a platform fifty feet high. The palace was like a fortress surrounded with thick walls and containing seven hundred rooms connected with corridors. The decorations, the paintings of the battle and hunting scenes on the walls, and the statues of lions guarding the royal entrance was praise-worty.

The BABYLONIANS conquerred the Assyrians and laid the foundation of may magnificant cities. The wall enclosing the famous city of Babylon was so wide that a four-horse chariot could be driven on the top and it was intercepted by two hundred and fifty watch towers along the rampart and hundred bronze gates giving entrance to the city. The walls were grand and impressive temples built on platforms in the form of lofty towars, the tops of which seemed to recede in the sky. Hanging gardens in the city, the greatest work of engineering contain tier after tire of terraces which rose one above the other supported by arches, the highest one was 300 feet above the ground. The gardens with beautiful flowers of various hues and myraids of the fountains gushing out crystal like water and playing on the terraces, lent a fascinating spectacle inded.

Egyptian Architecture.

"Eevery thing fears but time itself fears

*B. B. Joshi, Incorporated Civil Engineer, Registered Architect and approved Surveyer, Amritsar.

This paper was received in July '78

the pyramids of Egypt" says an Arab. Egyptians Pyramids, the unparallel tombs of the Pharoahs, the king of Egypt constructed in about 300 B, C. were the first buildings constructed on some technical basis. One of the greatest pyramids, the glory of khufu, is at Gizeh-a part of Egypt. It is the greatest and most accurate structure ever built and is about 480 feet in height. Built on a base of over 13 acres, it presents to the beholder more an appearance of a hill of stone than of a workof Architecture. There were large blocks of stone, the one of which measures 4'-11" high, 8'-3", on the bed, 4'-3" on the top from back to front, showing 6'-3" on the slanting face. They are fine white stones with polished faces. The great monument must have gleamed like a heavenly mountain. Considering that they had no lifting machines or cranes, the handling of such big stones appear to be rather incredible. This only makes us pause and think what genious, what talent and what amount of labour enabled them to accomplish that of which even modern science would be pround. Egyptians particular interest centered in building sculptures on a large scale, while with the Greeks it was a much less monumental affair. This was probably due to their belief in the migration of soul. While Egyptians provided permanent houses for the dead and had developed the science of embalming their mummies to perfection.

The character of a nation and the civilisation achieved by it are clearly reflected in their buildings. The great tombs and temples which are the remains of a glorious past of Egyptian civilisation, will bear out that the Egyptians were a people possessing extremely marked characteristics and their life was marked by religious fervour reverence philosophy of life, which made them to build for permanent and endurable structures. The Egyptians regarded life as of temporary nature and built magnificent tombes as their home after death. Their strong belief resulted in a national programme for the building of tombes and temples in the building of which they achieved perfection. It is noteworthy that side by side with the, marvellous exactitude of the construction of the pyramids, there are examples of inaccuracy in the setting out of the plans of some of the temples, in which they often the opposite walls of a symmetrical rectangular hall are far form parallel, and there are notable instances, where magnificent stone work is erected on instable fonudation. We find also that what often accompanies haste to obtain large effect is obvious inferiority of workmanship due to economy and labour. This was inevitable where the labour was largely conscribed and this lead to inequality of workmanship.

The buildings of Babylonia and Assyria were inspiration of strength and durability; while those of Egypt were colossal and enduring, but the Greek Architecture was beautiful and simple in form.

Greek Architecture.

The Greek Architecture consists of museums, schools, public halls, temples and theatres. It owned very much to Egyptians and Chaldeans than was supposed to be. It is considered to have reached the zenith of its glory in the age of percicles about 460 to 430 B. C. The buildings still existing are more or less in ruins, but the remains show that they were characterised by unity of design, beauty, harmony and decorated to the mark. The Greek Architec-

e has three orders, the Duric, the Tonic d the Corithien. The most marked, ough, not the only distringuishing feature these, is the decorations of the column d its superimposed entablature in certain pes. Roofs were generally low and sence of arches were the special features the Greek Architecture. While they re decorated with sculptures, the tails of structure were enriched by lerent colours and tints. The theatres re semi-circular on one side and square the other, the semicircular part being ually excavated in the side of some convent hill, the seats in this part called the uditorium were arranged in a concentric anner and accomodated as many as 20,000 ople. The temple at Diana is note worthy. fter the death of Aledander, the Great in 3 B. C. the Greek Architecture suddenly eclined.

oman Architecture.

Roman Architecture was borrowed from reeks and Etruseans. It consists of queducts, sewers, temples amphi-theataes, agnificent vilas, triumphal and monumental rches, bridges, Forum (market) law courts nd public baths. Though Roman constructed round arches after the fashion of truscans, yet they were original in using hem to their rectrangular and circular uildings. It reached the pinnacle of glory the last century B.C. under Cavies Octaious (31 B. C. to 14 A. D.) It lacked decoraon like the Greek one. As the country ourished on account of the spoils and ooties brought by them from the conquered ities, so the Architecture flourished giving lace to variety of new designs. They rected gigantic buildings, colossiums, pantheon, and the heatre at Marcellus. The Excavations at Pompii present examples of domestic Architecture of the first century of our era.

The Roman also invented concrete a mixture of lime, sand and pebbles. It is one of our most widely used building material to fhis day. The excavations at Knosses revealed a five storey structure with light wells, air conditioning running water, flushing lavatories, waste soil pipes. The Roman concrete foundations submerged in port Near Naples recently was still in good condition, unaffected by sallty sea water after two thousands years. It was made with the powdered volcanic tuff, excavated near Pozznala and mixed with lime. Pozzolanic cement is today accepted and has chemically similar properties to the pulverised fuel ash (from power stations) additions to concrete. The range of hydraulic cement available in E. E. C. countries may soon be seen herewith the binary and ternary blends of portland. Metallurgical and pozzdanic materials. Further development depends upon being able to quantify the strength obtainable under regular conditions of mixing and curing.

Indian Architecture.

India possesses one of the oldest civilisation, while great civilisation which held away in various ages have passed completely away. Here, in India is an unchanged look on life. The same social tradition that existed thousands of years ago has still full hold upon the minds of the people. India is not a small country, but a vast continent. Boardly speaking, both geographically and culturally there is oneness. But this unity is

split up into a diversity which often rises into sharp differences. There is a remarkable diversity of culture and social life in India, where men and women are laden with gold ornaments-and bristle with precious stones. These are several too, who are on the verge of starvation. Half savages dwell next door to the most learned sages on earth.

The excavations made at the following places have brought to light an old civilisatson that existed in the landthousands of years ago :-

i) Mohenjo-Daro, (Sind) This city in all probability might now forming the territories of Pakistan. have been built at the end of stone age, or at the begining of the metal period, as the flint knives in the kitchen of the poor houses and the copper tools in those of the well-to-do found from-the excavations, bear an ample testimony to the fact.

The town was so exquisitely planned with parallel streets and drainage system that its construction in that period seems quite incredible to us.

ii) Taxila. It dates back to the days of the Mahabharata, when the Hindoo civilisation had made rapid strides. The remains of educational institutions, the Budhist temples, the writings of the Greek historians bear a positive proof that the culture, civilisation, leaning and art of India, trade and commerce centered round the famour city of Taxila.

iii) With the coming of the Aryans into India thousands of years ago, began a different type of architecture. The ordinary houses were made of wood and mud and stone was used in the important buildings. The famous structures of the period are Bhudhist stupas at SANCHI near Bhopal. These stupas were built as memorial mounds to enshrine the relics of Budha or his saints. The Great stupa was built by Ashoka. It consisted of an impressive dome surrounded at the foot by a lofty terrace and the whole is enclosed by a stone balustrade broken by four gateways decorated with beautiful stone earvings.

iv) The Chief buildings of India are connected with her religion. These include the wonderful Hindoo temples. The temple at Bhuvaneshwar, dedicated to the lord of three words is the finest and marvellous temple in Orrisa, built between 6th 9th Century A.D. It is decorated with sculputures and carvings of animals which seem quite real.

v) Black Pagoda of Konarak, built in honour of the Sun God, Surya speaks eloquently of the genious of Hindoo splendid temples and sculptures in 13th Century. The magnificent work of art employed in the building ranks with some of the best Greek and Roman sculptures. It is wonderful how some life sized figures of animals carved from enormous blocks of stone could be hoisted to a height of 150 ft. without the aid of mechanical devices. The temple has a hall of one thousand pillars with the finest carvings.

vi) The most famous and unparalleled temple is the temple of the Fish-eyed

godess at Madura. Madura has been described as the Athen of South India.

ii) Kailash, the temple at Ellora carved out of the rock with all its inner rooms, towers, shrines forms in art similar to that of the Egyptian pyramids. It is artistically perfect and appeals to aesthetic taste being unique and magnificent structure.

ohammedan Architecture.

With the advent of Mohammedan in India, there arose in the land, the domes and graceful minerets of mosques, tombs and palaces, for instance:

) Quatab Minar.-a towering building built in the Pathan period manifests the Architecture of the period.

i) Jam-i-Masjid at Delhi is the grand and marvellous mosque with its walls of red stone.

ii) The Taj at Agra built for the tomb of Shah Jahan's dearly loved wife.Mumtaz Mahal, is the matchless, beyond comparison and unparallel mausoleum in the world. Built of glistening marble with domes and minarets, it is exquisite and peerless in design.

Besides Jam-i-Masjid and the Taj, there are scores of other buildings such a Diwan-i-Ama, Diwan-i-Khas, Takhat-i-Taos, etc. etc. erected in the Moghal period. King Shah Jahan has won a great reputation for his buildings. The medaevial cities of Delhi and Lahore rebuilt by Shah Jahan and Akbar respectively contain wonderful buildings.

iv) The most beautiful and artistic buildings of the sikh period are the Golden Temple, Fort of Gobind Garh at Amritsar and many other monuments in the various parts of the Punjab, Standing in a tank of immoratality with its walls made of marble and gilded copper, Golden Temple lends an impressive and charming sight.

There is an erroneous belief that the Hindoo mind did not possess the true aesthetic feelings which carried art forward. They hold that every thing really great in Indian Art has been suggested or introduced by foreigners.

Ferguson is emphatic in his declaration that, "there is no trace of Hinduism in the works of Jahangir and Shah Jahan. The fact is that archaeologists have persistently looked outside of India for origins of India art. This naturally leads to the false conclusion. The fact remains that for the vital creative impulse which inspires any period of Indian Art whether it be Bhudist, Jain, Hindoos, or Mohammedans, we will only find its source in the traditional Indian culture planted in Indian soil by Aryan philosophy, which created its highest artistic expression before the Moghal dynasty was established and influenced the greatest work of Mohammedan periods as much as other. It may be added that the pointed arch was known in India and that through their contact with the Arab who were connected with the Budhists of Western Asia, the Saraceanic builders learnt it. Thus the distinctive features by which saraceanic architecture is known from the indegenious architecture of India was Indian in origin.

Not only that the master architects and designers of the Taj were not all Mohammedan, but the disposition of the domes is essentially of Hindoo origin which is known in Hindoo Architecture as Panch Rattan—the shrine of the five jewels or the five headed knogdom of Shiva symbolising the five elements-earth, water, air, fire, and horizon. Hindoo Shilap Shahstars also mention of similar arrrngement. The prototype of the Taj may also be found in the Ajants paintings and other older works pointed arches of Moslem inspiration frame windows and doors, in which are set perforated marble grills of the type often in Hindu Temples. The arabesques and chevrons on the outside are Moslim patterns but here they take the form of semi-previous stones inlaid in the marble, a technique imported from Italy and mastered by Hindu artisans.

English Architecture

English Architecture has been greatly influenced by foreign ones. In fact, foreign models and styles have been domesticated in England. But they have been so thoroughly and admirably adopted and domesticated that foreign influence has been absorbed and changed into something far removed from the original models and the result may well-nigh be regarded as national expression.

We have no space to deal with the progress of Architecture in England, Germany, France, Italy, Spain or in America, but we may remark that interchange of ideas in the modern age tend make a far wider community of outlook and in the art there have crept in various features which are common expressions of requirements shared by people of all nations.

Modern Architecture

Gradually as civilisation progressed, mechanical devices, steam, electricity etc were invented to help us in the task of building and consequently greater things in building construction have been produced than before. The ancient and medaevial buildings were mainly of stone and brick. The modern buildings, besides of stone and bricks, are a great net work of steel and concrete and are comfortable, durable, attractive and economical in money and space, simple in construction but imposing to look at. They are fire-proof dam-proof, quake proof and immune from the attacks of white ants, fuugus, worms, and the changes of temperature.

KINDS OF ARCHITECTURE

ARCHITECTURE may be divided in the following main headings :

Industrial and Commercial Architecture

They include business firms carrying on manufacture, sale, purchase, exchange transport of merchandise and other industrial enterprises. The modern trend is towards larger shops, store, larger banks larger railway stations, larger industrial enterprises demanding larger plots. This trend for larger buildings has found its expression in cities like New York in the building of taller buildings kown as sky scrapers. Residential quarters on upper floors and offices on the lower ones of the building facilities greater case in operation of business because owners save time twice everyday spent in going to and coming from offices. So much profitable the industrial enterprises are that farms have been

verted into industrial factories for the t that the former yield indefinitely small enue as compared with the latter.

Hence very careful disigns are prepared the modern factories which are both ctional in character and have aesthetic ite.

cial Or Domestic Architecture.

It consists of private houses, villas, large, ldings with suites of apartments for ferent families on flat system, hotels, taurants, sanitoriums and clinics. It lects the civilisation and the manners of residents. Social architecture in the cent past has not flourished in India. e general trend of the houses built in htees and nintees are, to say the least, st insanitary. Houses were not built in y systematic way, very narrow lanes, most en blind with a drain in the middle, with uses on either side built with bricks and d or pucca houses with bricks and lime, th roofs of ballies or vallas or in some ses wooden rafters with low roofs and few ntilators-contitute the general architecture. gh buildings with sky lights ventilated all und properly and good stairs were the ceptions rather than the rule. Town anning was not known and these houses ere designed and built by uneducated istries who generally neglected the nitary requirements of their employers. unicipalities newly formed were notstrict enforcing any regulations of buildings. omestic Architecture has developed in fferent countries and climes according to e tradition and local needs of the people.

Some times it is due to the prevalent elief that smaller houses do not require any eatment from an architect. This will afford a strong reason for the insanitary buldings. But the fact is that the importance of good design increases as the amount of money available to build a house decreases. This applies not only to the house itself but also to the group arrangement. It heightens land values, credit and the building itself. People who adopt buildings as their business, always aim at producing a cheap building costing for less than the amount it would sell for.

In foreign countries state controls buildings and maintains minimum standard of public health by the act of legislature. Here, too, the municipalities have enaced building by e-law conforming to certain sanitary requirements, and hygenic improvements but they are not enforced with any vigour. The result is, as we have observed before, the growth of instanitary buildings some of which never receive adequate rays of the sun, and cross ventilation.

Recreative Architecture,

It consists of theatres, ball rooms, clubs, museums, bath halls etc. They should be comodious enough to accommodate hundreds of people. They should have a pretty large number of ventilators and windows fitted with exhaust fans to puff out foul air and bring in fresh one.

Educational Architecture.

It comprises of schools, college, universities, libraries, exhibitions, etc.

The architect in designing any educational building must keep the following points in view.

(a) Site. It should be away from the hustle and bustle of the city. In an

atmosphere, open calm, quite and healthy. No extramural or intra-mural drain or burial ground should be adjecent to it.

(b) Rooms. should be comodious, airy, well ventilated and constructed on a good plinth so that in rains, the dampness may not affect them adversely.

(c) A pretty large compound, together with a small garden should be attached to it. In short, such institutions should be hygienic and contain wide corridors, spacious halls, stairways, high ceilings for the protection of boys general health and eye-sight. Latrines, urinals should be separate from the main building or to be equipped with sanitary installations, if attached to one side of the class rooms.

State Architecture.

State architecture consists of Municipal and District Board buildings, post offices, custom Houses, Town Halls, Govenment Houses, Courts, Offices, Assembly Halls, Forts and other means of defence.

No money should be spared on such termendous construction, so as to make them of enduring character, awe-inspiring, magnificent, pearless, and matchless. They should be so imposing and unparallel in grace as to reflect the vast wealth of the Government. So colossal, gigantic and towering should be the structures, which ought strike terror into the heart of the beholder and thus manifest the strength of the ruling power. Such buildings prove the proverb-Architecture is history written in stone. They throw a flood of light on the primitive history.

Religious Architecture.

In the primitive and medaeivial ages, the leading thoughts which governed the people's mind were religious. All the nations had lavished fabulous sums of money in the erection of buildings such as temples, tombs and mosques. They not only served as houses for prayers but were educational houses also. They were the places for shelter of the orphans and the poverty-stricken. In the course of time the educationists have separeted educational institutions from the churches, but the latter still keep their functional character. They bring to light the civilisation of the period.

Monumental Architecture.

Memorials are often erected either in the memory of the dead by its relatives or in honour of victory of the Government over the enemy. They are generally in the form of temples, hospitals, schools, pillars, statuttes, sculpputures, tanks, etc. They should be ever-lasting and reflect the glory of the age like the state buildings,

Bioengineering and Health Care–India

By

T. G. KRISHNAMURTHY

The health care of 600 million people belonging to different religions speaking different languages and having their own social habits provides a formidable challenge. In developing nations like India, the funds available for health care programmes are limited. Preventive aspects needs greater attention in view of the socioeconomic conditions. Public education utilising mass media like radio, television (wherever possible) and newspapers in the regional languages is an extremely important factor. A realistic approach has to be planned considering the local conditions. Whilst a broad general plan can be suggested for developing nations, modifications may be necessary depnding on the local factors. The cost aspects are obviously of utmost concern. Patients are not in a position to afford the high costs involved in the present day diagnostic and therapeeutic measures utilising modern techniques. On the other hand, medical institutions have limited funds at their disposal to buy all the equipment. Acceptance of new techniques by the medical profession of the country is prerequistic and in fact forms the extent to which instrumentation is used. Fortunately, medical equipment are designed to provide maximum patientuser safety and long term performance. The higher longivity and lower rate of obsolescence of medieal equipment are of significance in developing countries.

One of the major objectives of the emergence of the new interdiscipline of biomedical engineering is to close the gap between medicine and engineering. The extent to which it has been narrowed down in the last two decades varies from nation to nation. In affluent nations, availability of funds enables greater participation of the medical and engineering specialists In seminars and symposia besides research projects. The situation is different in developing nations. Though technological competance and high intellect are available, their utilisation by the medical profession and institutions has been rather very limited. In general the medical profession is rather conservative and is most reluctant to change over to new techniques. These factors warrant a planned and realistic approach in a progressive manner to equip hospitals and medical institutions. A practical approach is to classify the equipment as ESSENTIAL, USEFUL and OPTIONAL (Table 1). It becomes obvious that equipment under ESSENTIAL are needed by hospitals in their day-to-day use irrespective of location or number of beds. USEFUL instruments may be procured at district level hospitals where required specialist facilities are available and one can expect enough inpatient

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This Paper was received in July, 1978

and outpatient workload. Urban hospitals can economically utilise equipment under OPTIONAL. A cautious apporach is suggested in regard to the utilisation of computers for the automation of certain hospital procedures. The economic aspects have to be analysed considering the socio-economic conditions in the concerned country depending on the availability or otherwise of manpower, In developing nations, very few medical institutions have resources to hire computer services let alone buy one. However certain major hospitals in the country and specialised institutions (Table 2) providing facilities for interdisciplinary research work can utilise computer facilities. Mass screening and mobile health care units are no doubt ideally suited for highly populated developing and under-developed nations. But these involve fair amount of financial resources for recurring and nonrecurring expenditure on equipment and personnel.

A lot, has been achieved despite all the restraints in the form of limited funds reluctance in the acceptance of new techniques, lack of public awareness Every effort is being made to overcome the barriers by dedicated and sustained efforts to promote bioengineering. Some factual figures gives one an indication of the progress.

Parameter	1951	(1975)
Life span	32 years	50 years.
Hospital beds	115,000	300,000
Medical colleges	30	100
Admissions	2500	12,500
Infant mortality rate	183/1000	140/1000
Mortality rate	17.4/1000	15.2/1000
Post-graduate and other institutions specialist	10	60

The above table is self-explanatory and needs no further elaboration. Many diseases are under control by planned preventive measures. Plague disease has been eradicated. Small-pox and malaria are practically extinct. New challenges arise in view of the rate of growth of population. About 20 percent (120 million) live in urban areas and the rest (480 million) live in rural areas. There is a hospital bed for every 2000 persons and a physician for 5000 persons. Nearly 70 percent of modern medical practitioners live in urban areas In the last 5 years, improved road and rail communications coupled with power supply filtered water and better sanitation in rural

;, has led to starting of polyclinics and ing homes in these areas. Upgrading ;00 out of 6000 primary health centres 30 bed rural hospitals is yet another ır step in providing better care. ernmental efforts in this gigantic task been ably augmented by voluntary nisations which account for about 20 ent of hospital beds. Technologically, level of competance is available and upto medical insitutions to avail of these ly competent and dedicated bioengis. Though cautions can be optimistic ıt the future. Planned utilisation of lable resources can lead to application nodern techniques to provide better entive and curative care measures. y new techniques are safe, simple and omical (both from patient's as well as ical institutions viewpoint) and can be sed even at rural hospitals. One can see wider utilisation of instruments in coming years.

BIBLIOGRAPHY

1. KRISHNAMURTHY T.G.—Instrumentation for hospital in India. Hospital Engineering, London, Vol 30, No. 17 Pp, 17—19,
2. KRISHNAMURTHY T. G.—Manufacture of X-ray and Electromedical equipment in India. C. S. I. O. Communications, Vol. 2, No. 2, Pp. 24—26.
3. KRISHNAMURTHY T.G.—Instrumentation for Health Care. I. E. T. E. Symposium on Bioelectronics, Dec. 1975
4. KRISHNAMURTHY T.G.—Biomedical Engineering and Industry. 15th Annual B. E. S. Conference, Edinburgh, Aug. 1975
5. KRISHNAMURTHY T.G.—Electronics in Medicine. 3rd Hungarian Bioengineering Conference. BUDAPEST Sept. 1974
6. KRISNAMURTHY T. G.—Electromedical Instrumentation in India, Med. Pro. Thro. Tech. New York. Vol. 2, No. 4, Pp. 189-92.
7. KRISHNAMURTHY T. G.—Instrumentation for Hospital in India. Biomedical Engineering, London, Vol. 8 No. 10, Pp. 435-37
8. KRISHNAMURTHY T. G.—Development and Manufacture Bio-instruments in India. 9th I. C. M. B. E. Melbourne Aug. 1971
9. KRISHNAMURTHY T. G.—Bioengineering Industry and Health Care in India. 10th I. C. M. B. E. DRESDEN, Aug. 1973
10. KRISHNAMURTHY T. G.—Instrumentation for hospitals in India. Note to I. C. M. R. Sept. 1976

TABLE—1

INSNTRUMENT CLASSIFICATION (Indian Conditions)

ESSENTIAL	USEFUL	OPTIONAL
agnostic X-ray Unit.	D. C. defibrillator	Deep X-ray unit.
ectro Cardiograph	Demand pacemaker	Cobak-6 Unit
E. Colorimeter	Convulsive stimulator	Electromyograph

TABLE—1 (*Contd*)

Essential	Usefull	Optional
Incubator	Diathermy	Electroencephalograph
Centrifuge	Ventilator	Echoencephtograph
Surgical Diathermy	Prem Baby Incubator	Renograph
Nerve-muscle stimulator	Clinical audiometer	Scanners
Ultrasonic Therapy Unit	Flame Photometer	Recorders
Infrared lamp	Medical spectrometer	Medical computer.
Emergency power supply unit	Ion therapy unit	Chromatograph
Respirator	Electro sleep unit	PH Meter
Voltage stabiliser	Patient Monitor	Electrophoresis
Opthalmoscope	Closed circuit television	Cell counter
	Multi stimulator, Cryoprobe	Auto analyser
	Artificial kidney	Instrumentation for
	Artificial heart	Intensive and coronary
	Lung machine	Care Units.

TABLE—2

Important Institutions Promoting Interdisciplinary Projects.

All India Institute of Physical Medicine and Rehabilitation.
National Institute of Occupational Health
All India Institute of Speech and Hearing.
National Institute of Mental Health and Neurosciences.
Institute of Avitation Medicine
Virus Research Centre.
Nutrition Research Centre
Indian Cancer Research Centre.
Roorkee Engineering College.
Harcourt Butler Technological Institute.
Institute of Electronics and Radiophysics.
Indian Institute of Science.
National Environmental Engineering Research Institute.
Indian Institute of Technology, Delhi, Bombay, Kanpur, Madras, Kharagpur.
Central Drug Research Institute.
Industrial Toxicology Research Centre.
Central Scientific Instruments Organisation.
Electronics and Radar Development Establishment.
Bhabha Automic Research Centre.
Defence Institute of Physiology and Allied Science
All India Institute of Yoga and Allied Sciences.
All Indian Institute of Medical Sciences.
Institute of Experimental Medicine.
Institute of Post Graduate Medical Education and Research
Jawaharlal Institute of Medical Education and Research.

Detection of Sugars in Protein free Leaf extracts of some common vegetable plants

By

SUNANDA CHANDA, M.Sc.

Some sugars are associated with leaf tein concentrate when pulped and ssed from different plant sources stenstein, 1976). Green leaves and sses contain a good amount of protein acceptable quality which can be used for mal and human consumption. After cipitating the protein, the fluid was left ich was a rich source of carbohydrates, ino acids, minerals and Vitamins. The of the present investigation is to analyse rbohydrate contents of the fluid. The f extract of the following plants were alysed for corbohydrate content :

Brassica napus L. (Mustard or Indian rape),

Raphanus sativus L. (Radish),

Brassica campestris L. (Turnip),

Amaranthus viridis L. (Amarnath),

Spinacea oleracea L. (Spinach).

Three kilograms of fresh leaves, collected m plants at the preflowering stage, opped to 5-10 cm long pieces, were washed twice in tap water and pulped in a laboratory pulper (Davys and Pirie, 1969) 500 kg of this pulp was pressed in a laboratory press (Davys and Pirie, 1969) for ten minutes at room temperature. Fibre part was then separated and the juice was collected in a container. Protein was then precipitated by heating the extract to 80° C; the protein curd was separated from the fluid by centrifugation. The fluid thus obtained was yellow to deep brown in colour which was shaken with 2% activated charcoal powder (Darco. G 60) for 30 minutes to absorp the maximum amount of colouring matter. The quantitative determination of sugar in the fluid was now done by colorimetric method, using anthrone. Systronic Colorimeter was used for this purpose. For qualitative detection of sugars, colour free fluid was evaporated to 1/10th of its volume in a hot air vacuum oven at 50°C and the residue was extracted by shaking with dry distilled hot pyridine (Malpress and Morrison, 1969) for 10 minutes. The solution was allowed to cool to room temperature and then filtered from salt residue. Thus inorganic materials could be removed without using cation and anion exchange resins.

Fluids from different plant sources mentioned above were spotted on

unanda Chanda, is with
dian Statistical Institute, Calcutta
This paper was received on October 1978

Whatman filter paper No. 1, 2—dimensional paper chromatography was performed. The first solvent system in all the cases was 90% phenol : water (80 : 20 v/v). Four different solvent systems were tried : (1) Ethyl acetate-Pyridine-water (10:4:3 v/v); (2) Benzene-Butanol-Pyridine-water (1:5:3:3 v/v), (3) Butanol-Pyridine-water (6:4:3 v/v) (4) Butanol-acetic acid-water (5:1:2 v/v). The spots of unknown sugars on paper chromatogram were compared with those of known sugars under identical coditions and their Rf values were calculated. Spots for each and every sugar were developed by standard method. After overnight run in different second solvent-systems the paper was dried in a current of air at room temperature. After drying they were dipped in 25ml acetone containing 0. 1 ml. 50% Ag No_3 solution and were dried again at room temperature,

The paper then dipped again in 0.5 N KOH (in 95% ethanol). On drying for 2 to 3 minute at room temperature dark brown Spots of Carboyhdrates on Chramatogram appeared. The paper was again dipped in 1% Sodium thiosulphate solution to obtain a clear background. Then respective Rf values were calculated.

Among the leaf extracts from different species of plants studied, total carbohydrate content was highest in Mustard and lowest in Spinach as it is evident from Table 1 Table 1 shows galactose and arabinose occur in lesser quantities than the other sugars. In some species these are absent. It may be assumed from this preliminary study that after extraction of protein part, the waste fluid may find some practical applications in the field where a rich source of carbohydrate is required as in the case of microbial fermentation.

TABLE :—1

Sugars detected in Protein free leaf extracts

Name of the plant	Glucose	Fructose	Sucrose	Xylose	Galactose	Arabinise	Total Anthrone positive material g/100 ml.
1. *Brassica napus* L Mustard or Indian rape)	+++	+++	+++	+	—	+	0.9
2. *Raphanus sativus* L. (Radish)	+++	+++	+	++	+	—	0.8
3. *Brassica campestris* L. (Turnip)	+++	++	++	+	+	—	0.8
4. *Amaranthus viridis* L (Amaranth)	++	++	—	+	—	+	0.05
5. *Spinacea oleracea* L. (Spinach)	+	++	—	+	—	+	0.01

ACKNOWLEDGEMENT

Thanks are due to Mr. S. Matai, Head, ;af Protein Research Unit, Biological iences Division, Mr. D. K. Bagchi, Lecturer and Dr. (Mrs.) S. Chakravorty, Guest-Scientist of the same Department. Indian Statistical Institute, Calcutta-35.

REFERENCE

G. M. Festenstein, Journal of Science, Food and Agriculture, Vol. II VII, 849 (1976)

M. N. G. Davys and N. W. Pirie, Biotechnology and Bioengineering, Vol. XI, 517-528 (1969)

M, N. G. Davys and N. W. Pirie, Biotechnology and Bioengineering, Vol. XI, 529-538 (1969)

4. Carbohydrate estimation by anthrone, Methods in Carbohydrate Chemistry, 1, 390 ed. by Whistley, R. L. and M.L. Wolfrom, published by Acad. Press Inc. (Lond.) Ltd., 1962

5. F. Malpress and A. Morrison, Nature, Vol. I VI IV, 963 (1949)

Articles and Notes are invited by the Editorial Board for publication in SCIENCE & ENGINEERING. Readers Views and Comments will be specially appreciated.

Unified Field Theory

U. P. MULLICK

SYNOPSIS

The paper is an attempt to equate Electromagnetic Field Energy with Gravitation under certain conditions. It is shown that at infinity in Universe condition Electromagnetic field energy is equal to gravitation. This is a State of Oneness, but unstable.

Paper

In the equation $mc^2 = e \pm x.x_1$, taking $mc^2 = E_k$ = Kinetic energy (or Radiation energy) and $e = E_p$ = Potential energy (or Electromagnetic Field energy) of the Universe system, and $x.x_1 = x_2$. G, a variable function of G or Gravitation, then the equation $mc^2 = e \pm x.x_1$

becomes $E_k = E_p \pm x_2$. G.

This equation can be rewritten as

$E_p - E_k = \pm x_2$. G

When E_k increases, that is kinetic energy increases in the system, mass increases in the Universe, value of $\pm x_2$. G diminishes, or force of gravity or gravitation decreases, tlil at the border of the energy shell system E_k = kinetic energy (or radiation energy) becomes equal to the E_p = Potential ener or electromagnetic field energy, and fo of gravity or gravitation is nil. The Radi tion energy is maximum, and infinite border of Universe, stabilised by the pote tial of electromagnetic field energy of t Universe.

A source, however, when $E_k = O$, E_r $\pm x_2$ G. That is, at source, electromagn tic field energy or potential energy is alo there (at infinite for Universe), and va of $\pm x_2$. G is also $= E_p$ = infinity. That in this condition at source of Univer energy, E_p = Potential energy or Electr magnetic field energy = Gravitation (force gravity), where Gravitation is also infinit $x.x_1 = x_2$ G being infinite. In this sta E_p = G or Gravitation.

This is a state of Oneness, but unstable

Reference :

Quantum Electrodynamics and Speed Greater than light. U. P. Mullick. Science & Engineering, Vol. 31, No. 9, September 15, 1978, pp. 167-180. and Vo 31, No. 10, October 15, 1978, pp. 190-2 Calcutta.

A READER WRITES

To
The Editor,
Science & Engineering,
Calcutta,
Dear Sir,

AND AFTER THE DELUGE

And after the deluge-what ? A vacuumyes, just a vacuum stares large on the starving face of flood-beaten West Bengal. If 30 years have already gone round to leave the refugee rehabilitation problem as burning and bitter as before-and this due to nothing else than to political bungling, the fate of the surviving millions under the grip of a larger havoc can well be imagined.

Of course, for some time now, crocodile tears would be shed, some reliefs would be made available for the sufferes but with time the whole show would diminish and ultimately vanish.

It is understood that the Government has appointed an Expert Committee to prepare plan for lasting prevention of such devastating inundation. Quite well and good. But, I think, this Expert Committee should have an Advisory Board of grey hairs like Dr. A. N. Khosla, Sri Kanwar Saiin, Dr. K. L. Rao, Sri Upalekar (the first Indian Director of the Central Hydrodynamic Research station, Poona), Sri Thirumale Iyyengar, (former Chief Engineer, Hirakud Dam) should be immediately constituted, whose good counsel and guidance would be available to this Committee.

Now about funds for relief and later on for rehabilitation, If is my considered opinion that all Ministers, Deputy Ministers including M. P's. and M.L.A's. from the State all who claim to be the protagonists of the people-should contribute at least 1 5days emoluments, which in itself would provide a huge fund.

Further more, our so-called salvation castles like Tarakeswar Mandir, Ramkrishna Mission, Anandamayee Ashram, Sitaram Ashram and all of them should be told that even foreign Churches were the first to volunteer offers of aid, in Cash and kind, for suffering humanity in an unknown land and should be obiliged to forgo part of their long-stored wealth even if as an investment in kindness. No small a sum, I think, this will provide.

Yours very truly,
Asis Chatterjee
Calcutta-700029

NOTES & NEWS

International School of Milling Technology at CFTRI :

The foundation stone for an International School of Milling Technology was Laid at the Central Food Technological Research Institute (CFTRI), Mysore on August 1978 by Shri Govind Narain, Governor of Karnataka. This is a collaborative venture of the Government of India and the Swiss Confederation to train personnel for executive and supervisory functions in the roller flour milling industry, the School lays special emphasis on conditions speafic to India and south and south-east Asia which share more or less similar problems. It is envisged that school will have a capacity to admit 20 trainees per course of 10 months' duration, and as far as possible one-third of these traintes will be from the countries of south and south-eart Asia.

Under the Indo-Swiss agreement the Swiss government would provide practical school mill and Laboratory apparatus and instruments amounting to about Rs. 41 lakh. Besides, it will provide training for three Indian experts at the Swiss School of Milling and also the services of an expert miller for a year or two.

Anticorrosive Treatment of Steel Reinforcement Rods

The Central Electrochemical Research Institute (CECRI), Karaikudi, has worked out an integrated process for anticorrosive treatment of steel reinforcement rods in marine environment. The integrated p cess consists of four stages ; (i) derus (ii) phosphating (iii) brushing two coats inhibited cement slurry, and (iv) seal The products required in the integra process are : (i) acid inhibitor in solid fo (Indian Pat. 465/Cal/75), (ii) Rust prev ting composition (Indian Pat. 109897), Composition for corrosion preventi reinforced concrete and brick work con truction (Indian Pat. 109784/67), and Portland Cement Coating for Steel (Ind Pat. 112440/67).

Cyclohexane Plant Based on RRL—Hyder bad Process

A one tonne per day prototype cycl hexane plant designed by the Region Research Laboratory (RRL), Hyderaba and based on the process knowhow a catalyst developed by the laboratory b been commissioned at the Gujrat St Fertiliser Corporation Ltd. (GSFC), Baroc The plant converts benzene in cyclohexan a basic raw material in the manufacture nylon 66. Presently, GSFC is producin cyclohexane using imported catalyst.

Oil pollution in the Arabian Sea

The research vessel Gaveshani of th National Institute of Oceanography (NIO Goa, during its 35th crusie surveyed a pa of the oil tanker route from south Sri Lanka to the mouth of the strait Malacca. The whole route was full floating and particulated residus wi concentrations ranging from 0.5 to 3.6 mg m^2 a fairly high amount comparison wi those of the other areas of the world

combining these observations with those made during the 31st cruise of Gaveshani in the Laccadive Sea, it can be concluded that the entire oil tanker route from the Gulf ports to the Far East and Japan, acr the Arabian Sea, greatly polluted w dissolved petroleum hydrocarbons rangi from 20 to 27 Mg/litre in concentration.

OUR AUTHORS

B. B. Joshi

Mr. Bir Bahadur Joshi obtained B.Sc. (Hons) Engg. degree in Civil Engineering from the Dover University, Delwars in 1944. He started his career as Civil Engineer in the Rehabilitation Department, Poonch State Properties in the Punjab Circle. Later on the started practice as Structural Engineer, Architect and Surveyor. He is also the Technical Advisor of the Municipal Committee, Chhaharta. Whole Sale Market Building, Amritsar, Hospital Buildings, Bridges, D.A.V. College Buildings, Flour Mills, State Bank Colony are a few amongst this important engineering works. Member of a number of learned bodies in India an abroad. Published several papers on engineering and architecture and responsible as author for book on valuation. Mr. Joshi joined India Society of Engineers as an Associate Member and was elevated to a Fellow and became its Vice-President.

T. G. Krishna Murthy

Graduated from Mysore University (1951); Completed Post-Graduate Electronics Course at Madras Institute of Technology (1955); Research Fellow in Biophysics, National Institute of Mental Health ar Neurosciences (1958-1961); part time Tuto St John's Medical College (1964-1968); Ho Adviser and Consulant to Industry, Medic Institutions etc, Member, ICMR Panel c BME, Medeless panel Electronics Comm ssion, Advisory Committee of Advance Training Institute on Process Instrumentatio and Electronics, Hyderabad, has over 2(publications to credit in the field coveri varied aspects like safety, developme manufacture, maintenance. marketin techniques; on invitation attended semina and symposia in India and abroad memb of several professional organisations in tl field. Hon. Guest Editor, issues on BME.

Sm. Sunanda Chanda

Sm. Sunanda Chanda (nee Ro Chaudhuri) obtained B. Sc. (Hons) degre in 1966 and M. Sc. degree in Botan in 196 She worked as Sr. Laboratory Assistant i Indian Plywood Industries Researc Institute for one year and thereafter joine Research & Training School, Indian statist cal Institute, Calcutta as a Scientific worke Since then she is engaged in various researc programmes on Leaf Protein. She has g a number of research publication to he credit.

SOCIETY NOTES

The next ANNUAL GENERAL MEETING of the General Body of the INDIA SOCIETY OF ENGINEERS will take place on Saturday, November 25, 1978 at 1 P. M. in the "BANQUET HALL" GREAT EASTERN HOTEL, Calcutta to transact the following business :

1. To confirm the Minutes of the Proceedings of the last Annual General Meeting held on February 3, 1978
2. To receive the General Secretary's Report on the Working of the Society.
3. To adopt the Audited Statement of Accounts and Balance Sheet for 1977 with Auditor' Report.
4. To elect new Members and to constitute the new Executive Committee.
5. To appoint the Auditor for the year 1978 and fixing up the remuneration.
6. To transact such other business as may be placed on the Agenda of the meeting by the Executive Committee or by Members with the approval of the President of the meeting.

●

Dr. B. N. Dey Memorial Lecture

Concurrently with the Proceedings of the Annual General Meeting, the year's Dr. B.N. Dey VIII th Memorial Lecture and Cultural Program will also be held. Members willing to attend these functions are requested to contact the General Secretary in advance to facilitate the arrangements for the Function.

●

'I S E Annual' Supplement to SCIENCE & ENGINEERING for December 1978

The Proceedings of the Annual General Meeting, also of the Dr. B. N. Dey VIIIth Memorial Lecture, the cultural Program etc. will be published in a separate supplement under the caption "ISE Annual Special to SCIENCE & ENGINEERING for December 1978."

APPEAL TO ISE MEMBERS

Po
26/12/78

Stand by the flood Victims

Main Text of Resolution moved from Chair at the meeting of the Executive Committee of the India Society of Engineers held on September 15, 1978:

The President and Members of the Executive Committee of India Society of Engineers, on behalf the Society express their deep sorrow at the death of many of our of Countrymen, Women and Children as a result of this current unprecedented flood havoc. A two minutes silence is observed standing in memory of the dead.

The India Society of Engineers express further their deep sympathy with the surviving people striken by the flood and its after math, and resolves that its members be requested to forward their donations freely to the Society earmarked 'The Chief Ministers' Flood Relief Fund' to maximum possible extent in this hour of distress of the flood affected people.

The Society also sympathises deeply for the loss and death of hundreds of domestic cattle due to the devastating flood. All remittance should reach this Office on or before November 25. So that the collected amount could be handed over to the Flood Relief Fund of H. E the Governor of West Bengal.

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CONTENTS

SCIENCE & ENGINEERING

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NORMATIVE AND STRATEGIC PLANNING.

TASAM is a set of lettesrs that stand for initials of the Finnish expression of setting and plan evaluation methods'. It helps the planner to articulate his ideas anning better and to plan better. The ground behind these ideas lies in practice ot in theory alone, which is the key to the dynamics and development in the ing process.

The principle says' if you do not set the goals, they will set themselves'. irces are not generally plentiful, but more often scarce. When you decide to use scarce resources, you fix the goals too. Every allocation of resources always implies nite change in the real world. These changes with their consequences either serve, disservice or leave entirely untouched certain interests. Thus the division of these sts are either beneficiaries. or are victims, or are simply outsiders.

For strategic use of scarce resources therefore, the main point is whether the goals t before, or they settle themselves after the decision-making. Has the decision r been aware of the goals, which will be served by the allocated resources ? For ple. a large amount of money by way of scarce resources have been collected from Central Government for relief and rehabilitation of the flood victims of the mber—October 1978 floods in West Bengal. A large amount of money has been ted through munificent public donations to the cause through the Governor's f Fund, Chief Minister's Flood Relief Fund, privately raised funds like Statesman f Fund, Ananda Bazar Flood Relief Fund, Sri Ram Krishna Mission Funds and the The total amount may come upto quite several crores of rupees. Now the ion is how this very large sum of money is to be rationally put to use in the most icial way to the public, and for benefit of rehabilitation of the flood victims in a g way for the country.

Now if the awareness of the specific goals happens prior to decision, then the rational way to do the spending is to do it through normative and startegic planning. the administration, say, makes the decision, it simultaneously must finish thinking gh the subject, Otherwise it is not a decision. What then the decision-maker d think, and what should he it think before framing an issue ?

The answer is 'The thoughts that guide the decision maker, can help make better ons, and dependent on the recognition of the proper goals in advance, and nition of the proper approach to obtaining such goals'. The whole question that

ought to be answered before a final decision is therefore, Firstly, who shall act (under which limits, in which circumstances, and starting from what ?)

Secondly, why ? (that is when, by which. and for whom?) and Thirdly, What (—with what Goals ?).

Once 'Who', 'Why' and 'What' are answered, 'How or the method of approach can be settled. These are in step with normative and strategic planning.

Sometimes one has no choice to make, but just one to take. Then operative planning is the only kind of planning there is need for. However ignoring normative and strategic planning in case of real and proper options, is ultimately risky in decision making.

By neglecting to ask 'Why' questions, the better and new answers and as well the uncertainties remain hidden. Further steps become non-rational, more random-like perhaps more believable and politically acceptable, -perhaps not, and most often not.

It is rather common in these days to disregard normative planning in favour of 'bluff-normative' planning. Strategic conclusions and policies, say for flood relief, have probably been already drawn, but it may happen, they need, for prestige or pragmatic reasons, some kind of nomative post explanation, decoration etc. Ignorance of the strategic planning, as well as substituting for it 'bluff-strategic planning, can have a different outcome depending on whether it is preceded or not by normative or bluff-normative planning. The greatest difference is that for an ad hoc co-ordination without preconceived strategy, which is rather common. It serves opportunistic political aim and gives short-sighted freedom to the decision maker., to apply arbuitrary arguments as a basis for the setlement of the goal and mode of planning.

In the case of a gap between the normative and operative planning, some special reasons are obstructive concealment of the strategy, or pre-emptive avoidance of responsibility. Sometimes there may exist defective or unnecessary normative and operational planning when the real options are not left open. Reasons for the lack of options might be of a technical character, but more often conditions for public strategic planning are not fully met. One then says' You can plan whatever, we do what we like, a saying familiar to many professional planners.

Thus the more essential, complex, enduring or significant the decision problem is, the more there is need for exhaustive enquiries before the decision. The whole circle of information in the administration should be as follows ; Reality-preception (including feed back) -value system-normative planning-strategic planning-operational planning-implementation of the reality perception as concretised through normative and strategic planning.

Ignorance of overlooking of these steps in the sequence many create shortcomings in the circle system. Avoiding timely these shortcomings minimises risks and uncertainties in giving the final shape to the goal or objective.

Confluence Analyses of Land Surfaces

By

Prof. GEORGE ALEXANDER

and

K. ACHUTHAN

duction

he imminence of a so-called population osion had made us cognizant of the value of our water resources. We are quite aware of the serious consequences will result if we continue to neglect and nanage this vital resource. With the llation explosion and resulting emphasis vater resource planning comes a need llect, compile, distribute and somehow enormous volumes of data. Because :he unique interdisciplinary nature of r resources, duplication of effort in obtai- and handling these data is inevitable ss certain counter measures are taken. ng with wasteful duplication of effort the possibility that much of the data not be made available to others than e who collected it. Also, the data may n a form that is not useful to others.

For these and other reasons it is iously in the best interests of all that rts in water resource planning be closely rdinated. Coordination of any such rt on a natural or global scale certainly requires the adoption of one common, uniform system that incorporates in it the interactions and interdependencies of surface waters. Confluence analyses of land surfaces is one such method of coordinating water resources activities.

f. George Alexander and K. Achuthan are with namalai University, Tamilnadu.

's paper was received on Nov. '78

Definition :

By confluence analyses of land surfaces is meant the analytical subdivision of a continent or island into successively smaller confluent and resulting multifluent regions.

A confluence is the junction of two or more streams or of one stream and a body of water. A confluent region, then, is a land surface that drains through the mouth of a single stream into another stream or body of water.

A multifluent region is a land surface that drains in multiple ways through the shore line of a stream or body of water. Multifluent regions are remaining areas left from subdividing a land surface into confluent regions.

Other possible applications :

Many additional uses of the proposed system are possible since the interactions and interdependencies of surface waters were

utilized in developing the principles of confluence analysis. A few such examples are as follows :

1. Water pollution—Establishment and location of interrelated stations for water quality networks.

2. Water rights—Tabulating and indexing locations of applications and permits.

3. Water supply augmentation—Coordination and evaluation of related weather modification efforts.

4. Water and snow management—Coordination and control of runoff management activities.

5. Water conservation—Coordination and evaluation of interrelated conservation measures.

6. Land drainage—Analysis of drainage methods and practices.

7. Watershed management—Control of experimental erosion and runoff studies.

8. Flood control—Study of drainage areas and waters contributing to floods.

9. Sedimentation control—Study of the areas contributing to sedimentation.

10. Climatological data—Storage, retrieval and dissemination of data as related to water resource activities.

Conclusion :

Clearly there is a genuine need for the adoption of a uniform system of coordinating water resource activities. The time and expense involved in developing modernized systems that are designed for today's high speed electronic computers and in converting to these systems must be considered. However, a more important consideration is how long case we afford to wait before we assume these very necessary tasks.

Confluence analyses of land surfaces is a feasible method of deriving a set of coordinates based upon the interrelationships among surface waters by analytically subdividing a continent into successively smaller order confluent and multifluent regions.

Articles and Notes are invited by the Editorial Board for publication in SCIENCE & ENGINEERING. Readers Views and Comments will be specially appreciated.

A Perturbative Solution of the Volterra Equations

By

Dr. UTPAL K. DE,

and

Dr. TAPAN K. DAS

The perturbative solution of the Volterra system of equations for the population of two interacting species has been presented. Comparison with the exact numerical solution of the Volterra equations shows very good agreement upto fairly large values of the perturbation parameter. However the third order solution blows up for t→α.

In this short communication we present simple analytical expressions for the turbative solution of the Volterra system of equations. The Volterra model for the ulation of two interacting species is characterised by the system of equations :

$$\left.\begin{aligned} \frac{dN_1}{dt} &= K_1 N_1 - \beta_{12} N_1 N_2 \\ \frac{dN_2}{dt} &= -K_2 N_2 + \beta_{12} N_1 N_2 \end{aligned}\right\} \quad \text{......(1)}$$

, N_2 are the populations of the two species ; K_1 , K_2 are their rate constants and β_{12} resents the interaction between the species. A simplified set of equations results if choose all the constants to be unity ; then the system of equations are,

$$\left.\begin{aligned} \frac{dx}{dt} &= x - xy \\ \frac{dy}{dt} &= -y + xy \end{aligned}\right\} \quad \text{..... (2)}$$

ere x and y are respectively the prey and predator populations in this rationalised del.

An exact analytical solution of the equations (2) is not possible. However t can easily eliminated and the solutions can be shown to be on a closed curve in the (x, y) se space[2]. Eliminating y between the two expressions of eq. (2), we have,

$$\frac{d^2 x}{dt^2} - \left(\frac{dx}{dt}\right) + x(x-1)\left(x - \frac{dx}{dt}\right) = 0 \qquad \text{......(3)}$$

al K. De is with Jadavpur University and Tapan K. Das is with Burdwan University.
paper was received in November '78

Eq. (3) is a second order nonlinear differential equation and no general exact solution exists. One can easily verify that there are two trivial solutions to eqs. (2)

$$\left.\begin{array}{ll} & x = 0\,, \quad y = e^{-t} \\ \text{and} & x = e^{+t}\,, \quad y = 0 \end{array}\right\} \quad \ldots .(4)$$

However no general solution can be found.

To solve eq. (3) perturbatively, we expand x in a series,

$$x = \epsilon_0\, x_0 + \epsilon_1\, x_1 + \epsilon_2\, x_2 + \epsilon_3\, x_3 + \ldots\ldots \qquad \ldots\ldots(5)$$

where x_i is the i-th order contribution to x. x_0 is obviously the background population over wich oscillations will take place. $\epsilon_0, \epsilon_1, \epsilon_2, \epsilon_3 \ldots$ are kept to recognise the various order of terms, but we will set all of them equal to unity at the end. Substituting eq. (5) in eq. (3) and equating terms of a given order, one have the following equations :

O-th order :

$$x_0 \frac{d^2 x_0}{dt^2} - \left(\frac{dx_0}{dt}\right)^2 + \left(x_0 - \frac{dx_0}{dt}\right)\left(x_0^{\,2} - x_0\right) = 0 \qquad \ldots\ldots(6)$$

1st Order :

$$x_0 \frac{d^2 x_1}{dt^2} + x_1 \frac{d^2 x_0}{dt^2} - 2\left(\frac{dx_0}{dt} \cdot \frac{dx_1}{dt}\right) + \left(x_0 - \frac{dx_0}{dt}\right)(2x_0 x_1 - x_1)$$
$$+ \left(x_1 - \frac{dx_1}{dt}\right)(x_0^{\,2} - x_0) = 0 \qquad \ldots\ldots(7)$$

2nd Order :

$$x_0 \frac{d^2 x_2}{dt^2} + x_1 \frac{d^2 x_1}{dt^2} + x_2 \frac{d^2 x_0}{dt^2} - \left[2 \frac{dx_0}{dt} \cdot \frac{dx_2}{dt} + \left(\frac{dx_1}{dt}\right)^2\right]$$
$$+ \left[\left(x_0 - \frac{dx_0}{dt}\right)(2x_0 x_2 + x_1^2 - x_2) + \left(x_1 - \frac{dx_1}{dt}\right)(2x_0 x_1 - x_1)\right.$$
$$\left. + \left(x_2 - \frac{dx_2}{dt}\right)(x_0^2 - x_0)\right] = 0 \qquad \ldots\ldots(8)$$

3rd Order :

$$x_0 \frac{d^2 x_3}{dt^2} + x_1 \frac{d^2 x_2}{dt^2} + x_2 \frac{d^2 x_1}{dt^2} + x_3 \frac{d^2 x_0}{dt^2}$$
$$- \left[\frac{dx_0}{dt} \cdot \frac{dx_2}{dt} + 2 \frac{dx_1}{dt} \cdot \frac{dx_2}{dt} + \frac{dx_3}{dt} \cdot \frac{dx_0}{dt}\right]$$
$$+ \left[\left(x_0 - \frac{dx_0}{dt}\right)(2x_0 x_3 + 2x_1 x_2 - x_3) + \left(x_1 - \frac{dx_1}{dt}\right)(2x_0 x_2 + x_1^{\,2} - x_2)\right.$$
$$\left. + \left(x_2 - \frac{dx_2}{dt}\right)(2\, x_0 x_1 - x_1) + \left(x_3 - \frac{dx_3}{dt}\right)(x_0^{\,2} - x_0)\right] = 0$$
$$\ldots\ldots(9)$$

e consider upto 3rd order of approximation.

ee x_o is the background population,

$$\frac{dx_o}{dt} = \frac{d^2 x_o}{dt^2} = 0 \qquad \text{......(10)}$$

nce from eq. (6), $x_o = 1$ ......(11)

bstituting this in eq. (7) we have,

$$\frac{x_1}{t^2} + x_1 = 0 \qquad \text{......(12)}$$

ence $x_1 = A \operatorname{Cos}(t + \alpha)$ ......(13)

iere A, α are constants to be determined from initial conditions. Substituting (11) d (12) in eq. (8) we have,

$$\frac{x_2}{t^2} + x_2 = - A^2 \left[\operatorname{Cos} 2(t+\alpha) + \tfrac{1}{2} \operatorname{Sin} 2(t+\alpha) \right] \qquad \text{......(14)}$$

he solution of eq. (14) is,

$$= \frac{A^2}{3} \operatorname{Cos} 2(t+\alpha) + \frac{A^2}{6} \operatorname{Sin} 2(t+\alpha) \qquad \text{......(15)}$$

In eq. (15) we do not introduce new constants, since the original eq. (3) is a econd order differential equation and we have freedom in choosing only two arbitary nstants. Substituting the zero-th, first and second order solutions, (11), (13) and (15) the third order eq. (9), we have,

$$\frac{d^2 x_3}{dt^2} + x_3 = A^3 \left[\tfrac{1}{6} \operatorname{Cos}(t+\alpha) - \operatorname{Sin} 3(t+\alpha) - \tfrac{1}{2} \operatorname{Cos} 3(t+\alpha) \right] \qquad \text{......(16)}$$

olution of eq. (16) is,

$$x_3 = A^3 \left[\frac{t}{12} \operatorname{Sin}(t+\alpha) + \tfrac{1}{8} \operatorname{Sin} 3(t+\alpha) + \tfrac{1}{16} \operatorname{Cos} 3(t+\alpha) \right] \qquad \text{......(17)}$$

This process can easily be extended to any finite order, however the complexity f the solution makes the calculations increasingly prohibitative. The n-th order olution is proportional to A^n. Thus A represents the perturbation parameter. Clearly, ince $x \geqslant 0$ (being the actual population of a speeies) at all times, $/A/ < 1$. α is an rbitary phase factor which can be determined from the initial conditions.

The perturbed solution upto third order,

$$x = x_o + x_1 + x_2 + x_3 \qquad \text{..... (18)}$$

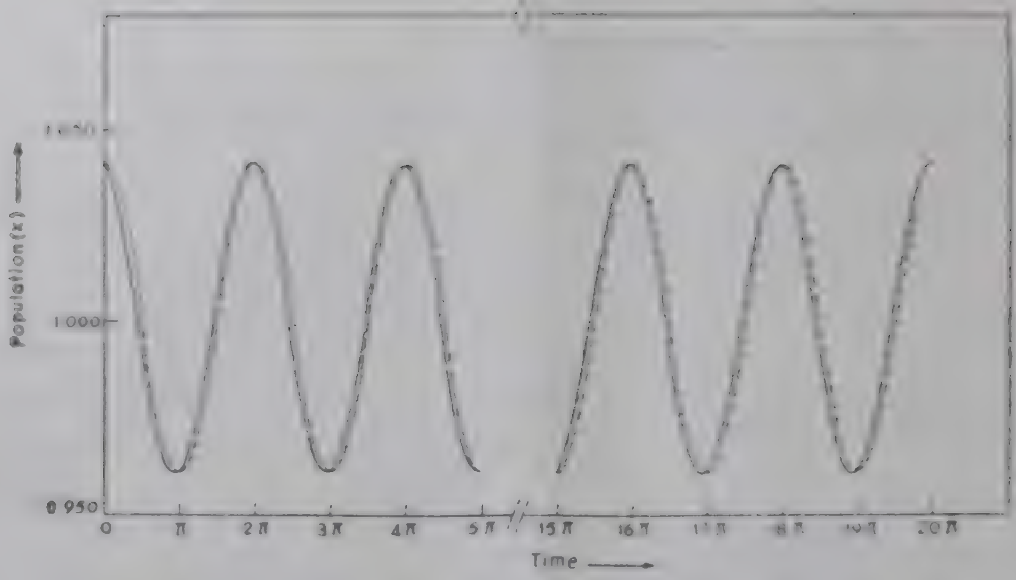

Fig. 1

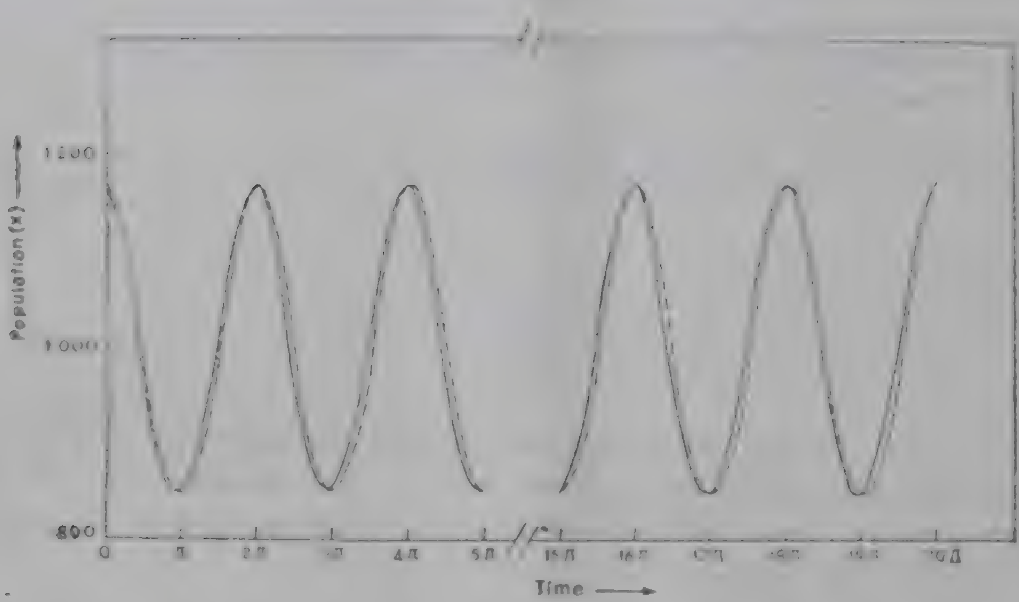

Fig. 2

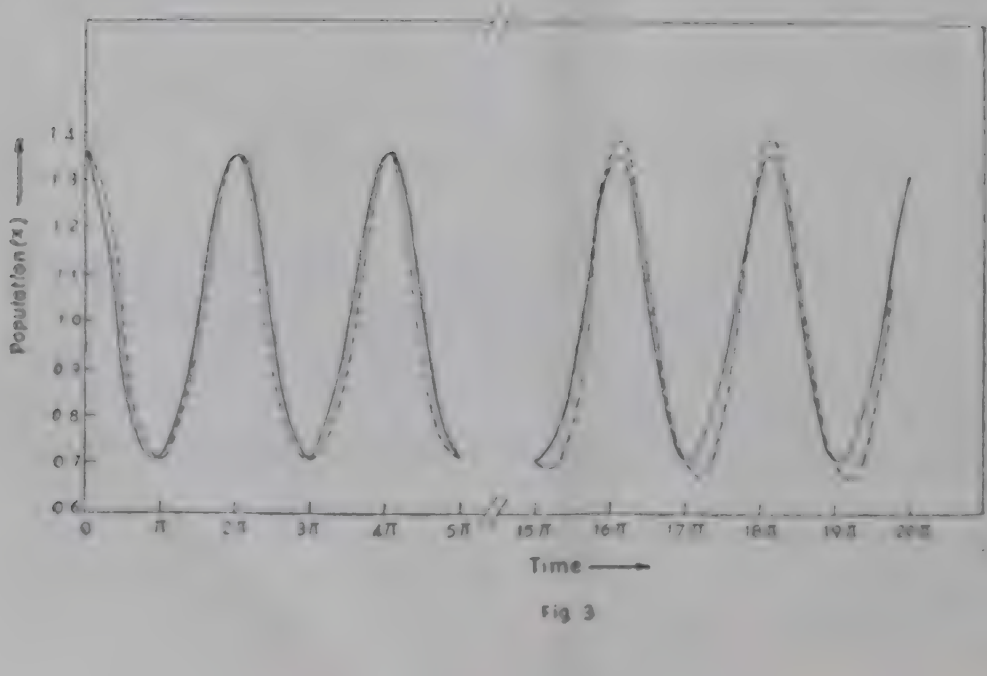

Fig. 3

:en plotted (dotted curves) for three representative values of the perturbation neter A, viz. $A=0.04$, $A=0.16$ and $A=0.32$. We have chosen $\alpha=0$ for simplicity. : have been shown in Figures 1 to 3.

We also carried out an exact numerical solution of eq. (3) using the same order .e-Kutta integration method (subroutine RKGS 1). The initial values x (o) and o) were chosen to fit with those calculated from the perturbation results. We have ed the results of the exact numerical calculations (continuous curves) on the same :s (Figs. 1 to 3). It is seen that the agreement of our 3rd order perturbation ts with the exact results is extremely good for $A=0.04$ and $A=0.16$, inspite of a shifting of the former curves to the right with respect to the exact curves. For).32, no such constant phase shifts occur, rather it is a bit erratic and the maxima he minima of the curves resulting from perturbation calculation are a bit stretched mparison with the exact curves particularly for higher values of time. This is quite rstandable in view of non-oscillatory t-dependent term in eq. (17). We also note the exact solution is absolutely periodic for all values of A and the period is 2π. is also true from the perturbation calculation within our calculational error for .04 and 0.16, however for $A=0.32$ this is slightly vitiated.

From the nature of the third order perturbation calculation x_3 (eq. 17) we see for time $t \to \alpha$, x_3 will blow up and clearly the pertuabation will fail. However upto y large t ($t \leqslant 20\pi$) and for a fairly large value of A ($A=0.32$), the perturbation its are in quite good agreement with the exact numerical results. Thus for finite s, our perturbation method seems to work excellently, which gives very simple ytical expressions (eqs. (11), (13), (15) and (17) for the various order contributions. method appears to be a powerful approximation method for the solution of non- ır second order differential equations.

ACKNOWLEDGEMENT

e wish to thank the staff of Regional Computer Centre, Jadavpur, Calcutta where computer calculations were carried out, for their efficient seivice.

References

Volterra, V. J. 1931. In 'Animal Ecology' by R. N. Chapman (Mc Graw-Hill, New York).

Rosen, R. 1970. Dynamical System Theory in Biology (Wiley-Interscience, New York).

Signs For Easy Understanding

By

Dr. N. SUBRAMANIAN*

1. Introduction

Big or small, garish or subtle, signs tell us where we are or where we want to go, while at the same time conveying something about the character of the place. Inherent in the nature of signs, however, is one basic conflict : in their role as identification they must draw attention to themselves without allowing the attention-getting device to interfere with the clarity of the information being conveyed. Since all the signs deal with information and, consequently words or symbols, most signs embody typography as a prime design element. The number of faces now available and the diversity of styles offer an idcredible range of choices. The scale of signage ranges from simple designation over a doorway to a system of traffic signs for use on all motorways.

As institutional facilities have become larger and more complex, the movement of people from their point of entry to their destination has had to depend on signage systems. The two systems discussed in this paper, as well as most others deal with both word and symbol in an effort to communicate with an increasing number of non-english people of the United States.

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Traffic Signs

In each and every country many traf signs have been developed and each driver trained to follow these signs. These signs co vey effectively their meanings even to tho who are seeing it for the first time. Ma traffic signs have been standardised all ov the world. With the increase in the number tourists all over the world there is a defini need to increase the number of road an traffic signs. The American Institute Graphic Arts, United States of America fe this urgent need and has developed number of symbols and signs in an effor to communicate with an increasing numbe of non-English speaking people. Some these signs are given in Fig. 1. These sig have been developed for four differen groups; viz. Public Services, Concession Processing activities, Regulations. Aft their imlpementation in U. S. A. they hav gathered excellent publicity in other parts the world. These signs were well appr ciated by the tourists.

3. Hospital Signs

Hospitals are the places where the signs can perform vital roles. With th increasing developments in facilities an inventions, the hospitals have grown bigg in size in many parts of the world. Thoug the receiption or enquiry section is availab in many modern hospitals, the non-Engl speaking people find it difficult to locate th different wards or sections. To help peop

Fig 1. Symbol Signs

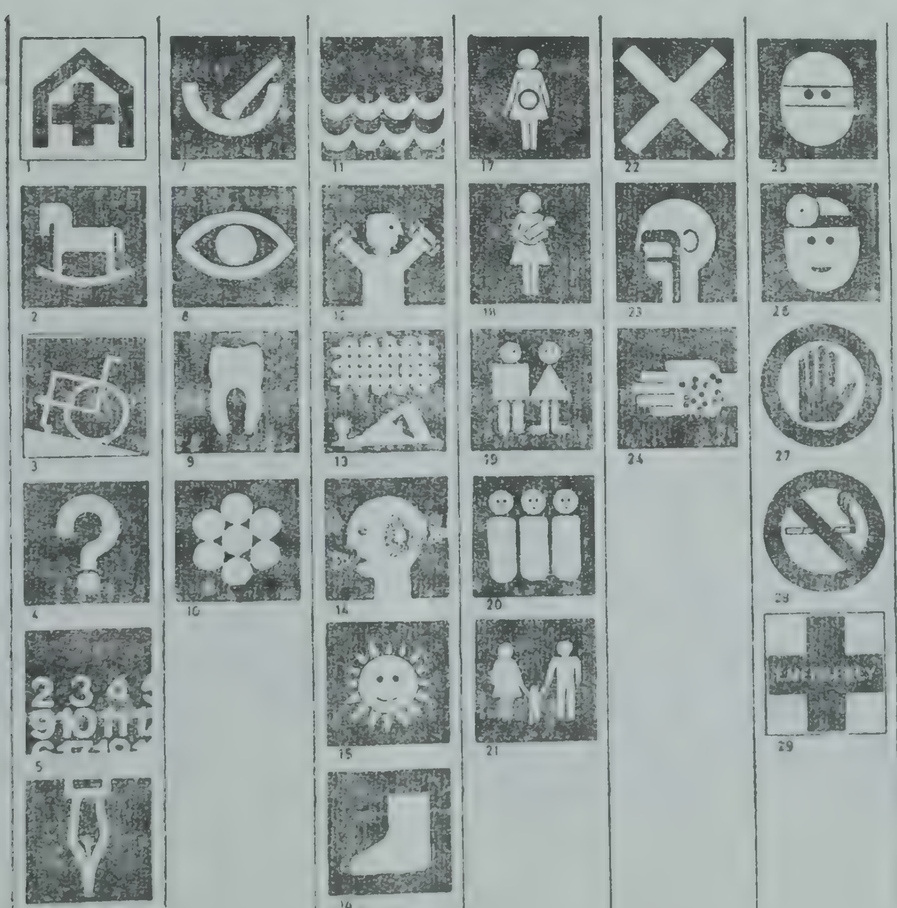


Fig 2
ealth Symbols

Fig. 1 : SYMBOL SIGNS

1. Telephone
2. Baggage lockers
3. Information
4. Rail Transportation
5. Car rental
6. Ticket Purchase
7. No Smoking
8. Mail
9. Elevator
10. Hotel Information
11. Air Transportation
12. Restaurant
13. Baggage checking
14. Smoking
15. Currency Exchange
16. Toilets-Men
17. Taxi
18. Heliport
19. Coffee shop
20. Baggage Claim
21. No. Packing
22. First Aid
23. Toilets-Women
24. Bus
25. Water Transportation
26. Bar
27. Customs
28. Packing
29. Lost & Found
30. Toilets
31. Ground Transportation
32. Shops
33. Immigration
34. No Entry

Fig. 2 : HEALTH SYMBOLS

1. Hospital or Medical Centre
2. Play room
3. Wheel Chair Access
4. Information
5. Appointment
6. Registration
7. Pharmacy
8. Eye care
9. Dental Care
10. Specialisties
11. Hydrotherapy
12. Physio therapy
13. Occupational therapy
14. Speech and Hearing
15. Mental Health
16. Orthopaedics
17. Female Care
18. Maternity
19. Child care
20. Nursery
21. Family Care
22. X-ray Department
23. Ear, Nose and Throat
24. Skin care
25. Surgical care
26. Medical care
27. No Entry
28. No Smoking
29. Emergency

ting these places, the New York City
1 and Hospitals Corporation has
ped a number of sings for the use in
ospitals. Some of these signs are
in Fig. 2.

om these symbol signs it is seen that
is a definite need for these signs in
politan cities of India, where many
ts from many parts of the world visit.
r to road signals and signs, these signs
d be taught to the people and
arized.

onclusions

l the State Governments are slowly
ing two language formulae and it is difficult for the common man who does not know the regional language or Hindi to understand the name boards, boards kept in hospitals and other important places. Also, India is becoming one of the important tourist countries in the world and hence it is very important to keep signs in vital places, which do not involve any language and which are easily understood. The signs shown in this article are useful in guiding even illiterate people.

Reference :—

Ryder, S. L., 'A Sign of the Times' Progressive Architecture, May 1976, pp.70-77

THE MOON

By

MANISHI BARANWAL

ne moon, since the dawn of civilization
been the object of intense interest,
nd and a matter of philosphy. Prior to
century it was thought up as made of
e. In 1610 Galileo saw through his
cope the valleys, mountains and plains
since then map of moon has been pre-
d naming these features. The great
ers and volcanoes could be identified and
ed. The first lunar photograph appeared
840. The scientific and direct explo-
on of moon became a possibility in this
ury with the development of spacecraft revealing its geological structure and other facts of its origin.

The moon is 384,402 km, from earth and its mean radius is 1738 km. The average density of the moon is 3.34 gm./cm^3. and the value of gravity is 162 cm./sec^2. The first spacecraft Ranger-7 crash-landed on Aug. 1964. Luna-9 was first spacecraft which softlanded on Feb. 1966. First manned spacecraft Apollp-11 landed on 20th July 1969 on the site known as Tranquillity base and two astronaughts Neil Armstrong and Edwin Adrin collected rock samples. The samples presented the results that the moon is devoid of water, organic matter and life.

ishi Baranwal is with Geological Survey of India
s Paper was received on August 1978

The surface temperature varies between 384°K (111°C) to 102°K (-171°C). Hydrogen, helium, neon and argon are present in lunar atmosphere. The gas concentration is 2×10^5 molecules/cm^3. in night time. The lunar surface is constantly impacted by 70 to 150 meteorites every year ranging from 100 gm. to 1,000 k gm. in weight at present.

The face of the moon is having large ringed basins, large craters, smooth plains, wrinkled ridges, low albedo areas and lava flows. The areas which are seen dark but are generally flat areas of the moon were formerly thought to be seas are technically called mare (plural maria). These maria are generally filled up with lava flows.

The large lunar craters range in diameter from 32 to 95 km. and are apparently one to four kilometer deep. These craters are amongst the greatest landscape structures present. The origin of these craters is explained mainly by two hypotheses : one giving the impact origin while other explains it by volcanic activity. Large craters are generally circular in nature while minor craters show asymmetry. The asymmetry is due to impact of secondary ejactor or by shielding effect of fault scarps. The present view is in favour of impact origin of these craters. Larger craters have typical central peaks which are formed due to elastic rebound during the impact event.

The peak rings is also a widespread feature on the lunar face whose origin is thought to be associated with impact forming craters, perhaps during collapse of the central peak. The next feature—large ringed basins are originated due to impact of large meteorite or comets. The material filling these basins is also called mare. The ... nearly 43 large basins with diam... greater than 220 kms. and the distr... is random. One of the largest hav... 2,000 km, in diameter. Due to high te... perature produced by impact of meteor... etc. the glasses are formed on moo... surface. The shape and the size of the glass bodies range widely. Most comm... shapes are dumbbells, teardrops and ro... Rock and mineral fragments welded tog... ther by glass is called agglutinates and formed during micrometeorite impact ... soil. Lava floods forming the maria occur... between 3.8 & 3.2 billion years ago ... lunar uplands were formed between 4.6 & billion years ago.

On the lunar surface there are regio... of excess mass concentration per unit ar... which are called mascons. These ... identified by positive gravity anomal... Most of the circular maria with diameter greater than about 200 km. give su... anomalies. Filled crators shows th... negative gravity anomaly i. e. regions deficit mass concentration. Many theori... have been proposed to explain it, the simple explanation is that the basalt filling th... ringed basins produces the shallow dis... shaped mascons.

Similar to earthquakes moon also ha... quakes called moonquakes. These qua... are confined in two belts along great circ... & compare with the smallest of the terrest... erthquakes (intensity 2 on Richter scal... The depth of moonquakes is around 1000 k... The moon has got magnetic field which vanishingly small, however the rock sam... indicate an ancient magnetic field no... vanished.

e various space missions helped up to ɔser to the mechanism of its origin in understanding the solar system. ld hypotheses of its origin fall in three as below :-

The formation of earth and moon simultaneously as a double planetary system.

The moon formed from the earth by fission.

The moon formed elsewhere but captured at a latter date by solar system as a satellite of earth.

ıe above theories are unable to explain ata obtained by Appolo spacecraft.

ıe first theory is the least popular of three explanations given above. The ·y fails to explain the low density of moon compared with earth (5.56gm/) Further orbital plane inclination of n does not satisfy the condition of its ation as a double planet. If both bodies formed from the same portion of solar la, how earth is 1.6 times denser than moon ? However the formation of n by chemical fractionation could cause be less dense than earth. The chemical position of lunar interior as obtained ı rock samples does not satisfy this lition and hence does not support the ry.

'he second theory of fission hypothesis ided a solution to the density difference ween the earth and moon. The original tion of this theory proposed that tidal es separated the moon from the earth. density of the moon in that case will hat of uncompressed density of the upper mantle of the earth. This theory is unable to explain the dynamical objections raised and the inclination of the lunar orbit could also not be explained. Except this some basic geochemical objections are in the theory. There are strong evidences that the luner interior is dissimilar to the earth mentle.

A modification of the above theory has been suggested by combining the double planet and fission theory and is known as precipitation hypothesis. This theory could not solve the dynamical difficulties. According to this theory moon was formed by accretion from a ring of planetesimals which formed around the earth following the condensation of the planet. In this hypothesis the earth began to condense from the cold solar nebula material. As the earth grows bigger and bigger its gravitational attraction increases and the gravitational energy of the infall material increases. The temperature of earth in final stages approached 2000° K and all incoming material at this stage vaporised. The atmosphere consisted of mainly hydrogen, carbon monooxside and few percent of volatilised silicates. The moon formed from the condensation of the volatile silicates and attained its present size by sweeping larger objects due to increasing value of gravitational attraction. The capture of these large objects produced the giant ringed basins by Impact.

The third theory assumed an accident of capture. The hypothesis was advocated to explain the density problem. Does moon and other satellites in the solar system has the same composition chemically ? The

lack of knowledge in this respect is serious limitation to solve this hypothesis. Such large satellite capture by earth would wseep up all other smaller objects from the surrounding forming large ringed shaped basins. The age of these basins can be calculated. All such basins should have more or less same age to support the theory.

After the Apollo data became available. complex theories were evolved to explain, the origin of moon. One of these mentions that during the condensation of the solar nebula selective condensation depleted the volatile elements and number of bodies were formed in the form of planeticimals with different metal cores. These planeta... approach the earth and disintegrate ... impact if within the limit called R... Limit. A large number of such ... within the Roche limit escaped from im... ting the earth and accumulated in ea... orbit as a ring. These accrete to form ... moon. This Hypothesis could solve u... great extent dynamical and density prob...

However solution of basic question... the nature of the early solar nebula ... formation of various planets by conden... tion process are expected to be obtain... when more data from moon becom... available in future years.

NOTES & NEWS

Scientist Combat Blindness :

Among the Chief causes of blindness one should mention pigmented dystrophy or retinitis pigmentosa. A new preparation—enkad consisting of a mixture of some nucleotides has been designed by Soviet Scientists proved to be effective in improving acuteness of vision considerably after several sessions of the intramuscular injection. When the disease did not advance too far, especially among children, the visual field was expanded and, the retina became electrophysiologically active. A symposium on the pathogenesis and treatment of hereditory pigmented dystrophies of retina has recently been held in Moscow. It was attended by prominent scientists from the Soviet Union, the United States, Great Britain and the German Democra... Republic.

Refresher Courses

The Refresher Courses Departme... University of Roorke is organising a sho... term refresher courses for serving engine... in different branches of engineering ... applied sciences from time to time. T... duration of these courses is normally ... weeks.

Eligibility for Admission

The candidate must be a Graduate ... equivalent in respective branch of E... neering, preferably with some field ex... rience. A certificate is awarded on satis... tory completion of the course.

Expenses :

The following expenses will have to ... borne by the candidates.

1. Tuition-cum-admission fee @ Rs. 400/- candidate.

2. The tour expenses of nearly Rs. 200/- candidate.

Boarding and lodging for the participants available in the trainee-officers' hostel of the university. The daily expenses are about Rs. 20/- per head.

For further details please contact Dr. P. P. Sahgal, Director, Refresher Courses Department, University of Roorkee, Roorkee (U.P.)—247-667.

SOCIETY NOTES

Recently Brain Trust Sub-Committee aded by Mr. U. P. Mullick submitted a port on Rehabilitation of Flood Victims suggested Methods of Rehabilitetion and e same has been forwarded to the Chief nisters of West Bengal, Bihar, Orissa, tar Pradesh and also to the Prime inister of India for their consideration fore finalisation of future planning.

Full text of the same report are given re.

●

Rehabilitation of Flood Victims AREPORT

On Suggested Methods of Rehabilitation

troduction :

The recent Cataclysmal floods in North dia, specially in West Bengal, calls for me serious thinking on methods of habilitation. Much money is being spent. and and Villages have been razed to the round. This gives some opportunity to y out model villages for rehabilitation of the flood victims to ensure them better life, and for better layout of the Country side.

1. Zones Covered :

The Zones immediately covered in this report are states of West Bengal, Bihar Orissa, Uttarpradesh and Delhi.

2. Opportunity For Physical Rearrangement :

The floods having in major places devastated and erased the Villages, provide an opportunity for Physical rearrangement of Villages through merger and redistribution of lands and layout of model villages, instead of doling out money to build on existing hutment sites.

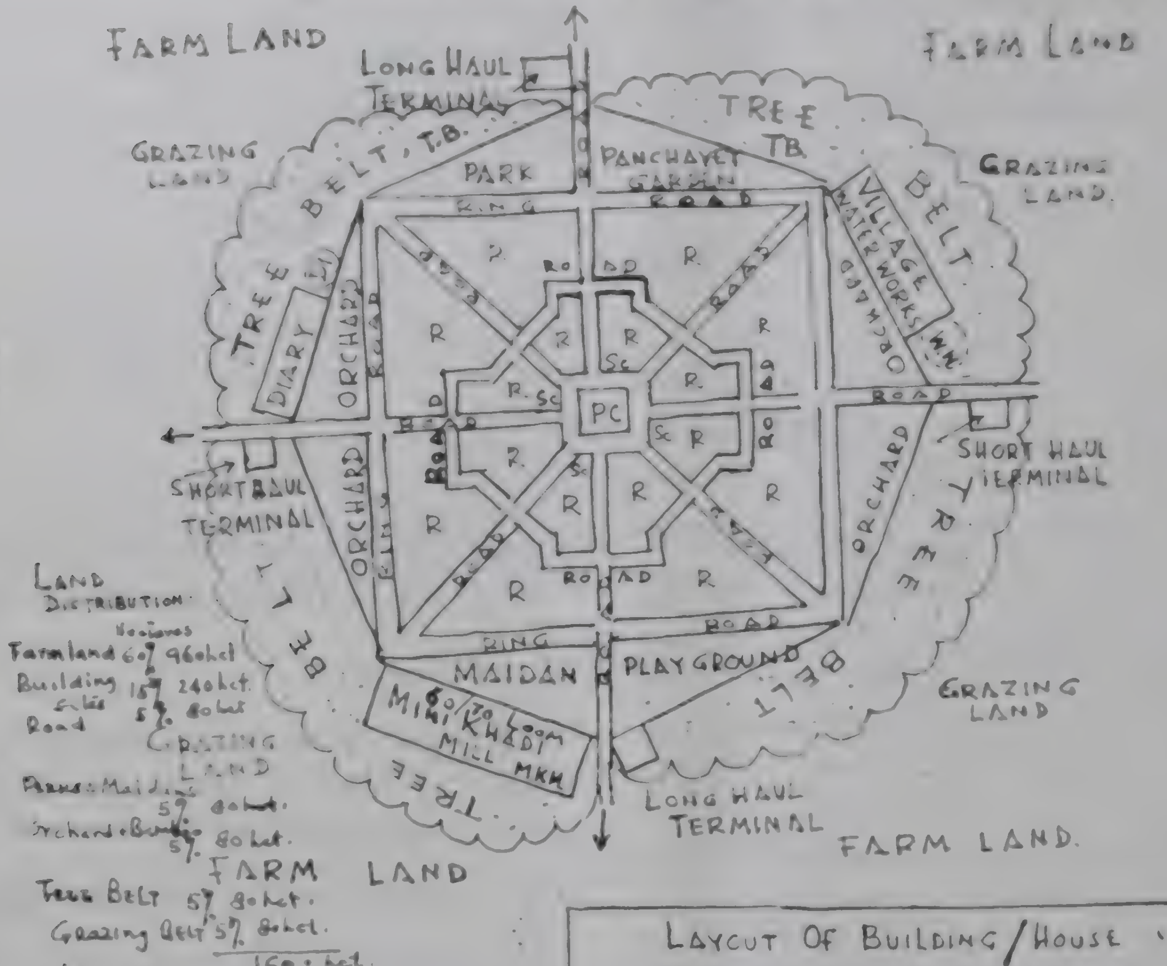
3. Nature of Facilities Required :

The Nature of Facilities required are :

1. Residential sites and building and utility buildings.
2. Small attached village workhouses for cottage Industry.
3. Fruit Cultivation.
4. Timber trade.
5. Farming and Farm land.

LAY OUT OF A MODERN INDIAN VILLAGE

- FOR REHABILITATION OF FLOOD VICTIMS AND GENERAL -



LEGEND:

R : RESIDENTIAL AREAS

PC : PANCHAYET CENTRE & BLDG.

SH : SHORT HAUL TRANSPORTATION POINT

LH : LONG HAUL TRANSPORTATION POINT

MKM : MINI KHADI PLANT

WN : WATER WORKS

OR : ORCHARD

TB : TREE BELT

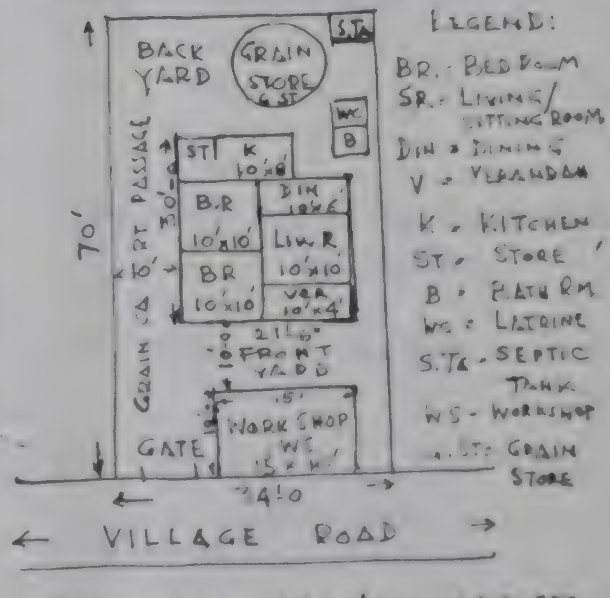
Ro : ROAD

DI : DIARY.

Sc : SCHOOL.

10. 11. 1978

LAYOUT OF BUILDING / HOUSE



SPECIFICATION: LAND AREA: 1360 SFT = 3 KOT 4CH 40 SFT.

WALLS IN BRICK BASE BAMBOO MUD LATH

ROOF: TILE / THATCH ROOFING

PLINTH: HIGH IN BRICK.

- . Water supply and drainage.
- . Long haul and short haul transportation of goods and produces and their terminals.
- . Mini Khadi Mill for Khadi development on Mini Scale.
- . Dairy on co-opertive basis.
-). Parks, Garden, playgroud and public Address Maidans.

Layout of Village Structure :

The proposed layout of village structure s per attached village plan and building plan.

The Panchayet Centre (or Community tre) is at the Centre of the village from ch radiate the 8 Village lanes with transse Lanes, marking out building plot es. Care is taken to give variety in place onotony.

The Residential areas are surrounded by hards on two opposite sides, ban dy 1) k and Village Panchayet garden and 2) idan and playground on the other two s. The Mini Khadi plant, Water works, nsportation haulage points are on the ge. The village is surrounded by tree t for bamboo clumps and timber,

The farm lands, grazing lands and irriga- system surround the village on outside.

A Tank may be an addition, and also a essity.

The Mini Khadi Mill may be upto 60 to looms.

Village shops are at Vantage points oining Residential areas, as well schools.

Residential Blocks ;

Each residential block is about 70′×40′ or about 3 Kotta 4 Chittacks 40 sq. feet more or less. It provides.

A Residence of 3 Rooms (2 bed rooms & 1 sitting room) of 10′×10′ each

One front Verandah 10′×4′
One rear Verandah cum Dining space 10′×6′

One store cum Kitchen 13′×8′.

A Seperate Latrine (Septic) and bathroom 4′×4′ and 4′×6′ each room.

A Village industry attached workshop 15′×10′

An inner Court yard 10′ deep

A rear Court yard or Grain store yard 20′ deep.

A side passage for handcarts and grain carts 10′ wide.

Probable Costing .

Each family house has a plinth area of

Main block $29\frac{1}{2}' \times 21\frac{1}{2}'$	:	634·25
Bath & Latrine $11\frac{1}{2}' \times 5'$	:	57·5
Workshop 15′×10′	:	150·0
Total	:	841·75 sq. ft. say 842 sq. ft.

Probable cost @ 842 sq. ft. @ 4/- Rs. 3368/- each household block.

Each household is taken at 5 persons to one family.

Financing :

The share of state financing may be about Rs. 1000/- per household, the balance of Rs. 2368/- being provided by the state as subsidy at 25% at Rs. 592/-, and balance Rs. 1776/- may be earned by the Villager

himself and spent on the building gradually as per layout plans.

Community Facilities :

All Community facilities like Panchayet Centre building, Parks, Gardens, Maidan, Playground will have to be maintained by the Village Panchayet, apart from Village Library and Meeting Hall and Water Works.

Dairy :

The diary is suggested to be on co-operative basis.

Mini Khadi Plant :

The Mini Khadi plant is also suggested to be on co-operative basis.

Shops :

The shops will be built by the Panchayet and let out to individuals.

Trees and Orchards :

The orchards can be on Community or co-operative basis, and trees also on co-operative planting under control of Village Panchayet.

India Society of Engineers has opened their Khargpur Chapter on 13th August 1978. Sri J. K. Tewari has been elected as the Secretary of Khargpur Chapter. Sri S. M. Sarkar presided over the inagural function.

The report of the inagural function came out in a local Hindi Daily "Sanmarg" on 19th August 1978.

OUR AUTHOR

f. George Alexander

of. George Alexander had his Engineering cation in the college of Engineering, indy, Madras. He is in the teaching fession for the past three decades. He ow Professor and Head of Civil Engiring Department at Annamalai Univer-/. He is a Fellow of the Institution of gineers (India). He is a member of ISE. has published number of papers. He is sently engaged in research related to drology.

Achuthan

Ar. K. Vchuthan obtained B.E. degree with nours and M.Sc. (Engg.) from Annamalai iversity in 1960 and 1965 respectively. iring 1976, he was deputed by the Governent of India to attend the 7th International st-Graduate course on Hydrology, held Budapest, Hungary. He got the First nk from among the 15 participants all er the world. He is in the teaching ulty at Annamalai University for the last o decades. He is presently engaged in ochastic hydrology research. He has blished a number of papers.

Dr. Utpal K. De

Dr. Utpal Kumar De obtained M. Sc, in Pure Physics and D. Sc. from Calcutta University in 1965 and 1976 respectively. He joined Kalyani University in 1966 and is engaged in the teaching profession since then. His present interests are General Theory of Relativity and Mathematical Biology. Published a number of research paper. Presently he is associated with Jadavpur University.

Dr. T. K. Das

Dr. Tapan Kumar Das, a Jagadish Bose National Science Talent Search Scholar was educated at the Presidency College, Calcutta obtained B. Sc. (Hons) degree in 1963 and M.Sc. degree in 1965 from University Calcutta. He obtained Ph.D. in Theoretical NuclearPhysics from the University of Pennsylvania (Philadelphia, U.S.A.) in 1971 He did his Post Doctoral work at the Technische Universitat Munchen (Munich. West Germany) from 1971 to 1972 Dr. Das joined the Universidade Federal de Pernambuco (Recife, Brazil) as Professor to the Chair of Nuclear Physics in 1973 and served there for 3 years. He has wide experience

of guiding research in Theoretical Nuclear Physics. He has published a number of research papers in the field of Theoretical Nuclear Physics and Ecology in National and international journals of repute Presently he is associated with the University of Burdwan.

Dr. N. Subramanian

Dr. N. Subramanian was graduated in Civil Engineering from Madurai University in 1972. He took M.Sc. (Engg.) and Ph.D. degrees from the College of Engineering, Guindy and the Indian Institute of Technology, Madras respectively. Author of more than 40 papers in National and International journals. Dr. Surbramanian is presently with the Indian Institute of Technology, Madras. His fields of interest include Space Structures, Optimization, Solar Energy and Dynamics. He has also written a book on computers which is to be published shortly.

Manishi Baranwal

Manishi Baranwal obtained his M.Sc. Degree in Physics from Lucknow University in 1965. Initially after teaching in Lucknow Christian College for few months he joined Instrumens Research & Development Establishement, Debra Dun. In 1967 he joined Oil and Natural Gas Commission Dehra Dun and was engaged principally in exploration work of oil and natural gas till 1974, thereafter joined Geological Survey of India as Geophysicist where he is working presently. He has been associated with many projects in GSI in connection with exploration of minerals, preparation of geotechnical maps and solving various engineering problems by using geophysical techniques. Member of Institution of physics (London) and India Society of Engineers. He has published many articles and papers in various journals/magazines.

Spplement to

Science & Engineering

Special Number

Vol 31 December 1978

PRESIDENTIAL ADDRESS

AND

GENERAL SECRETARY'S REPORT 1977

AT THE

44th ANNUAL GENERAL MEETING

OF

INDIA SOCIETY OF ENGINEERS

AT THE

BANQUET HALL, GREAT EASTERN HOTEL

CALCUTTA

ON SATURDAY THE 25th NOVEMBER 1978

&

DR. B. N. DEY EIGHTH MEMORIAL LECTURE

HOUSING : AFTER THE DELUGE

BY

SHRI NARAYAN SANYAL, B.Sc. B.E., F.I.E.

Liason Officer, Eastern Region, N. B. O.

Govt. Of India.

Acknowledgment

The Society of Engineers acknowledge their heartiest appreciation

for the generocity of

M/s. Golden Electric Lamp Mfg. Works

of

14-A, Gorachand Lane,

Calcutta - 700014

For distributing Folders to the participants of the

44th Annual General Meeting

held on 25th November '78

and

Mr. I. B. GHOSH,

3, Chittaranjan Avenue,

Calcutta - 700013

For his Courtesy for offering tea at the

44th Annual General Meeting

held on 25th November 1978

and

The members of Press attending the

Annual General Meeting.

ram : WISERISE (C) Calcutta Phone : 22-0105

INDIA SOCIETY OF ENGINEERS

12B, NETAJI SUBHAS ROAD, CALCUTTA 700 001

GENERAL SECRETARY'S REPORT—1977

he President and fellow members :

On the occasion of the 44th Annual General Meeting, here today, I take the leasure of placing before you the Report of the working of the Society for the year 977. The year under review is memorable with full of events and activities. Hard-ressed with politics and personality-cults the Executive Committee was faced with ilments of un-decession and the office bearers were unable to show much progress n their activities for the past couple of years. The climax of this was inherited by ne at the time of my assuming the office on the 25th March, 1977. To clean off nese problems and to show a few activities, I owe much to our President, other ffice bearers and a few of the Executive Committee members.

he Executive Committee, office bearers & Sub-Committees.

The 41 members Executive Committee constituted at the 43rd Annual General Meeting held on 5th February, 1977 took the office on 25th March, 1977, when they eld their 1st meeting to elect the office bearers. Sri U.P. Mullick was unanimously e-elected as the President. M/s. R. K. Banerjea, B. Singh, J. B. Aga, V.R. Kuloor, Λ. Kupuswamy, B. N. Roy Chowdhury and I.B. Ghosh were elected as Vice Presidents ınanimously.

It is perhaps, due to keen interest in participation in our activities, the 1st time n History of the Society I was elected by Voting with secret Ballot to the Office of the Hony-Secretary.

The other office bearers elected were as follows :—

xecutive Secretary	: Mr. G.L. Sinha.
loint Secretaries	: M/s. S.M. Sarkar & P.K. Chaudhuri.
Hony Treasurer	: Mr. Sudhin Bhattacharji.
ibrarian	: Mr. B.N. Ghosh.
Editor	: Mr. D.K. Das.

Later on due to resignation of a few members the following Changes in office bearers were effected.

Vice Presidents : Only six from the above list excluding Sri R K Banerjea.

Executive Secretary — Post kept vacant,
Hony Treasurer — Sri B.N. Roy Chowdhury.

The following Sub-Committees were elected to assist the Executive Committee:

1. **History of the Society Sub-Committee.**

   Terms of Reference : Compilation of facts and records relating to the History and development of the Society.

2. **Constitution Amendment Sub-Committee.**

   Terms of Reference : To draft new Constitution of the Society.

3. **Editorial Board.**

   Terms of Reference : Guiding Editorial and General Policy of the Society Journal and looking after its publications and General improvement and finance.

4. **Development Sub-Committee.**

   Terms of Reference : (i) farthering the interest of the Society in various states in India and abroad.

   (ii) Classification of members, category and statewise.

5. **Finance Sub-Committee.**

   Terms of Reference : Conducting the financial affairs of the Society and the accounts and audit of Society fund.

6. **Publicity & Public Relation Sub-Committee.**

   Terms of Reference : (i) Organisation of symposiums, lectures, meetings and Social gatherings, etc.

   (ii) Liaison work with sister organisation in India and abroad.

   (iii) Promotion of publicity of the Society.

7. **Library Sub-Committee.**

   Terms of Reference : Catalogueing and publication of list of books and periodicals and general improvement of the Library.

8. **Technical Sub-Committee.**

Terms of reference : Examinations and Technical matters and Technical service to members.

9. **Brain Trust Sub-Committee.**

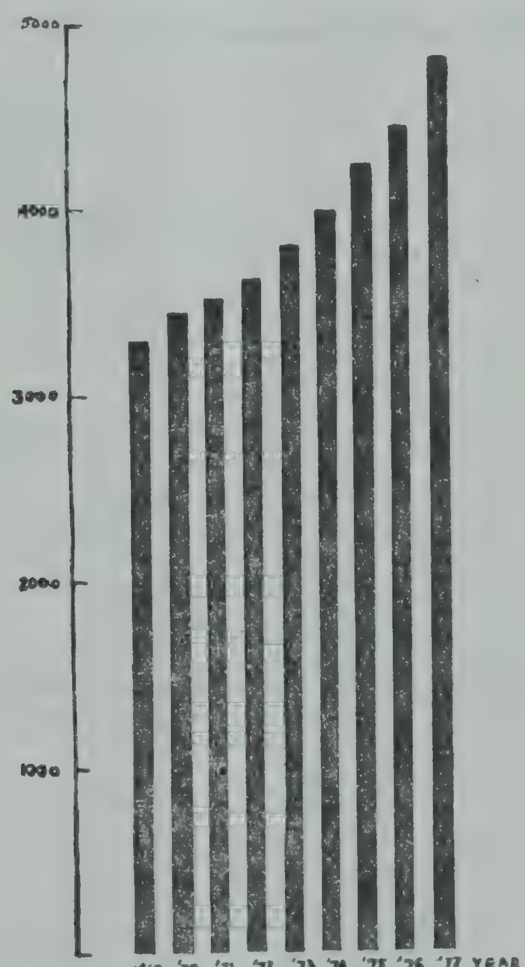
Terms of Reference : (i) Improvement of Technical matters. (ii) To review and suggest on matters connected with Engineering policies and development programme to State and Central Government and Local bodies.

10. **Scrutinising Sub-Committee**

Terms of Reference : To scrutinise applications for different grades of membership and submitting recommendation to the Executive Committee.

Membership.

A graph Showing the growth of the Societys' member ship is given below :—



MEMBERSHIP

The membership on our roll as on 31st December, 1977 is 4752. The membership Strength increased by 347 during the year, which is an all time record.

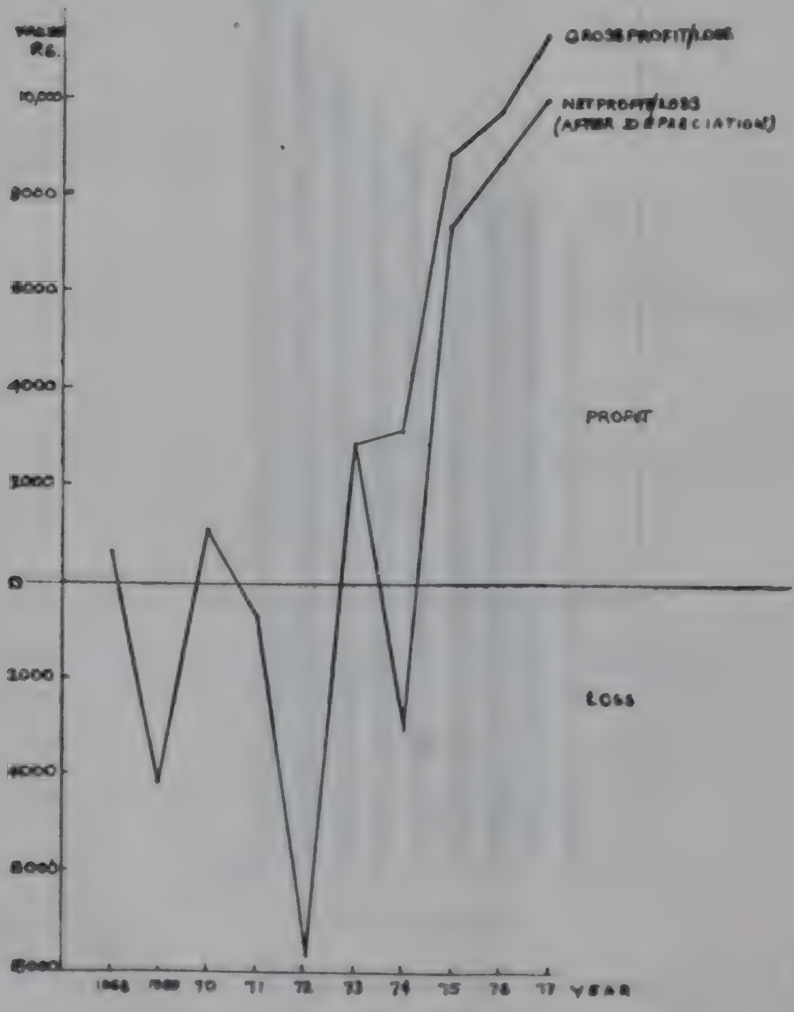
Finance :

Finance of the Society was the centre of critisism for last couple of years. A number of radical reforms were introduced for proper control and ecconomy. For the first time a budget was prepared discussed and approved in the Executive Committee meeting. Review of the income and expenditure in comparision with budgeted figures were carried out every month by the Finance Sub-Committee and Executive Committee. Special efforts were made for collection of Arrears (Membership fees and Special Annual fees) which yielded encouraging results.

The E. C. Committee resolved to send reminders to the defaulters of Membership fees and do the needful in accordance with the by-laws. Expenditures were also properly screened. Book of Accounts were made up to date.

The working of the finance of the Society is reflected in the Audited Statements of Accounts & Balance sheet for the year ending 31st Dec. 1977 as circulated to you along with the notice for this Annual General Meeting.

A graph showing income over expenditure for past 10 years is reproduced below.



PROFIT & LOSS

Even with all these bright pictures, we are yet lacking in sufficient funds for our activities in the context of higher cost and expenditures of the present days.

Activities :

Compailation of the History of the Society

Though the progress made in compailation of the History of the Soclety is not much satisfactory, Annual reports on the working of the Society and the Audited statements of Accounts for last 14 years were collected. Matters relating to the Registrar of Societies were regularised and made up to date.

Constitution Amendment :

It is felt by all that recognition of the Society membership is a must. Qualifications, Rules and Regulations governing admission to different grades of membership need radical change to secure recognition. For this purpose Constitution is to be ammended. Examination system for qualifying for different grades of membership is to be introduced. The constitution Amendment Sub Committee held a series of meetings and evolved at certain decisions. The major portion of the Draft constitution is ready and it is expected to be published during the next year. I would request all the members to give a serious thought to the constitution reform, send their suggestion and cooperate in implementing the same.

Brain Trust Sub-Committee Activities :

The Brain Trust Sub-Committee held a few meetings. It has made a recomendation on "Transportation infrastructure" to the Ministry of Transport, Govt. of India. Copies of the same were submitted to different Ministries and to the Prime Minister. This recommendation was acknowledged and forwarded to the exicutive bodies for necessary action. We are indebted to Sri U.P. Mullick our President and the Chairman of the Brain Trust Sub-Committee for his keen interest in formulating this recommendation.

Scrutinising Sub-Committee Activities :

All the applications received for different grades of Membership werethorughly scrutinised by Scrutinising Sub-Committee from this year on-wards, prior to the placing before the Executive Committee. This became absolutely necessary to maintain the Standard of our membership. Necessary clarifications and certificates were called for from applicants as and when required by the Scrutinisig Sub Committee. The efforts made by the Sub-Committee are worth mentioning here.

Lectures and Refresher courses :

The Society conducted two courses of R. I. Classes for the Trade Apprentices under the guidence of the Apprentice advisor, Govt. of West Bengal in association with Association of Engineers. About 80 students took part in the above classes. Mr U. P. Mullick and Mr. D. K. Das took the lecture classes from the Society's side. Paper meetings could not be conducted regularly for lack of fund.

Library :

Though the Society s Library is not very big, it is having a good number of of books and periodicals. Our Library has in stock a few volumes of valuable reference books. We are receiving periodicals from all the parts of the world and from all most all the technical Societies and Institutions. Work of catalogueing of the books are in progress and is expected to be completed in the ensuing session.

cience & Engineering :

Of all the activities of the Society, publication of its Journal "Science & Engineering" is the most important one. Our Journal is our mouth-piece, a medium of our publicity and the only link we regularly maintain with our members staying in other states and abroad. Acknowledging this importance and the necesity to improve its standard we have spend Rs. 11,143.54 against Rs. 7,486.35 last year. Size of the volumes are enlarged, get up improved and standard of articles are raised during this year. The earnest effort of our Editor Mr. D. K. Das deserves special mention here for achieving the above results. We are also greatful to Sri U. P. Mullick for his contribution of articles, editorials and general guidence as the Chairman of the Editorial Board.

We are in a position to improve our Journal manyfold and to bring it to the standard of that of the International Societies. But the restriction is only the finance. As you could see from the Statemants of Income and Expenditure, our largest expenditure is on our Journal and our collection for the Journal by the way of subscription or advertisement is negligible or nil. It is our earnest request to you to help us in collecting advertisements and subscriptions for our Journal "Science & Engineering."

Another important achievement for "Science & Engineering" is its docomentation by Indian National Scientific Documentation Centre, Council of Scientific & Industrial Research, India. All the volumes of the Journal, now, are documented.

Directory of Membership :

The Executive Committee, this year, decided to publish a Directory of Membership, first time in the History of the Society. All arrangements were worked

out and a token sum of Rs. 6/- was decided to be collected from indenting members. Preparations are in progress, but due to lack of interest shwon by our members in sending their requisition, the matter is not yet gone to the press. The estimated expenditure for publication of the Directory is about Rs 6,000.00 and the collection till now is about Rs. 696/-only. We hope with re-newed effort and blessings from our members we will be able to publish it in the next year.

Building Fund :

With a better financial Management, we hope that we will be able to build our own building to accommodate the Society's office and auditorium in the near future. It is absolutely essential for us to have a better accommodation to improve on our activities and to project a better image of the Society. The collection on building fund, started about 5 years ago, is only Rs. 886.82, a mere sum. Perhaps it is the result of the lack of publicity and not the lack of the interest on the part of our members to own a building that resulted in a poor performance on this account. May I request every one of our members to contribute liberaly for the building fund which I promise will not in vain.

General :

The Society stood with the Govt. in the natural calamities such as flood hazards. We have donated Rs. 101/- to the Priminister's Relief Fund. Again, we are giving our technical expertise and advice to the authorities concerned to tackle such problems.

Conclusion :

I am thankful to the members in attending the meeting and paying a patient hearing to me. I express my earnest gratitude to the President the Executive Committee members, Office-Bearers and Office Staff for their active guidance and assistance in performing my humble duty. I thank M/s. S. Sengupta & Co., Chartered Accountants, Auditor of the Society for the Financial Year 1977. M/s. Gupta Printers Pvt. Ltd., Printers of the Society Journal "Science & Engineering" and the authorities of the Great Eastern Hotel in associating with us in our activities. Thank you all.

Sd/- S. SARATCHANDRAN
General Secretary

PRESIDENTIAL ADDRESS

President Mr. U. P. Mullick's Presidential Address at the 44th Annual General Meeting of India Society of Engineers at the Banquet Hall, Great Eastern Hotel, Calcutta, on Saturday the 25th November 1978.

Our honourable Chief Guest, honourable friends, Fellow members, ladies and gentlemen, and gentlemen of the Press,

My address to you of this year is tinged with sadness at the catastrophic ravages of our country and the people by the calamitous and unprecedented floods of the 25th September last and after. One cannot get out of mind the serious situation created by the 1978 floods, practically unparalleled during the last 100 years. The dark terrific nights, the sudden rising waters and onrush of the floods, the cyclonic winds, the wailing of the hundreds of human hearts, the huge loss of human lives, and vast number of domestic animals, the gruesome condition in the wake of the floods, rushing and taking away everything of value including lives, were a veritable deluge, were a nightmare in the wake of the floods, not only for the flood striken people, but for the whole country. I wish no enemy even suffered such colossal calamity and loss.

The heavy rainfall in the catchment areas of the Ganga and the Jamuna and other north Indian rivers, the onrush of flood water in Delhi, Uttar Pradesh, Banaras and in Bihar towns and villages, and the final blow of the floods on as many as eight southern districts of West Bengal, besides heavy gale and floods and rain in Orissa, were as a whole a natural calamity for the whole of North India practically and a severe blow to India as a whole.

Things have been slowly recovering, the dark dank nights are over, the venomous hissing of the flood waters are no more, the flood waters have been slowly, slowly subsiding, leaving bare to eyes for any one to see, the havoc wrought to the people and to the countrysides, laid waste miles after miles. as far as eyes can see. Villages have been bundled up and broken up, villages have been erased like men and animals, leaving no trace behind. The administration has been up and doing, money has flowed from the State and from the people at large for relief of the striken, for temporary shelter and food to save the lives of millions. Medical assistance has been rushed to prevent epidemic, and for medical relief. The outside world has sent sympathy and offer of assistance for the flood victims

So it is not possible now to think of anything more problematical than the 1978 floods, and its aftermath. Now that the floods have subsided, and things are slowly returning to life, what about the problems of aftermath ? The 1978

floods have set thinking everybody in the country, the administrators, the politicians, the engineers, the irrigation and waterway specialists, the dam specialists, the metereologists and upper air investigators, the doctors, the philanthropic bodies, the Railways, the farmers and the common men alike.

In the light of the 1978 floods that broke all records from 25th Septembar to 5th October last for unprecdented rainfall, the specialists have to think again and again on the methods of weather forecasting, planning, construction methods, drainage canals for water, and on revision of data on catchment area rainfall, storage capacity, number, size and height of dams, and on various aspects of human settlements along the flood zones of the river valleys. There is a strange unpredictable uncertainty in the methods of rainfall and brewing storms, the paths they follow. The 1978 September-October rainfall was in continuous torrents over a wide flung area of South West Bengal. It started first with unprecedented heavy rainfall a little earlier in the catchment areas of the Ganga and the Jamuna, and of other rivers of Uttar Pradesh. The floods swamped Delhi first, then successively the towns of Uttar Pradesh and assembled at Banaras. Then sweeping down Bihar, it hit the hardest eight of the southern districts of West Bengal.

The coastal area of Orissa did not escape the ravages of the tornadoes and the high tides from the effects of the low pressure belts in the Bay of Bengal. The rivers Darakeshwar, the Damodar, Rupnarain, Kangsavati, Shilavati, Ajay, Jalangi, Maurakshi, Kunur and Brahmani were overflooded, affecting the eight districts of Midnapore, Hooghly, Howrah, Murshidabad, Nadia, Burdwan, Beerbhum and others simultaneously. Even Metropolitan Calcutta too was not spared from the ravages of the floods and the tornadoes.

The flat deltaic situation of the southern districts of Southern West Bengal is such that flood waters cannot recede quickly. Even from before the partition of Bengal, the low lying flat lands of the rivervalleys of West Bengal were populated by the people with their agriculture. After partition of the country, there were vastly more human settlements in these areas. The natural drainage also got affected by the increasing number of bunds, fish 'veri's etc. Besides there were also other problems like the size and number of water power multipurpose dams, their heights, capacities, and discharge methods and rates. All these factors have contributed to the extent and length of stay and gravity of the floods.

While man has no power to control the 'depression' in the Bay, the growth, movement and direction of motion of the tornadoes, or to regulate the rainfall, yet he can atleast do something to regulata the discharge of the flood waters by improving the drainage system by adequate data collection of rainfall in the principal catchment areas of the rivervalley rivers, the adequate storage capacity, size and height of the

dams, and their methods, extent and timing of discharge of water operations. It is saddening to find that while the people were dreaming of a happy Puja season with bumper crops, whether rich man in his palace, or a poor man in his hut, the heavy rains, the gales and the floods came, and mauled to bits the countryside and laid it to devastation. Where was our technology that we boast of ? Where was our expertise that we claim, has grown up over the centuries ?

Our weather specialists can now postmortem the effects and causes of the floods, and tell us why and how there was such heavy rainfall, and consequent floods, whether there is a cycle of rainfall over a decade, or over half a century, or over a century, whether the conditions causing rainfall are changing, whether the viriation of the upper atmosphere has effect on such excessive rainfall.

The Ganga is generally unpreditable. but this year its behaviour was unprecedented, affecting with heavy floods the rivers of Bihar like Sone, Poon Poon, Gandak, Kosi, Adhorara of North Bihar. All these lead one to question 'Is it possible to contain the floods and its effects ? Is it possible at all ?' As things stand at present, the obvious answer is 'No'. So the question then again is, 'So then what ?' What the barrages and dams on Kansavati, Damodar, Barakar, Mayurakshi stand for, what Farakka Barrage stands for ? Are they sufficient to cope with specially heavy rains ? Are the containing capacities and the number of our dams sufficient ? Our planners, our administrators, our water power and irrigation specialists have to think again and again on these aspects. The Messanjore Dam and the damaged Tilpara Barrage on the Mayuraskshi were meant to supply water for irrigation, and not for flood control as such. Their capacities were not such as to control the flood waters and so the flood waters could not be contained, but had to be discharged at the very time when the lowlying down side areas were subjected already to heavy rains and floods.

It appears the dams of the DVC system that were erected with much fanfare are not sufficient in number and capacity to contain the highest extent of rainfall water of the catchment areas and of the upper reaches. Either the number of the dams have to be increased from 5 to 8 or the height has to be increased. The latter is not practicable at present for the existing dams. The question of partial silting of these dams is also there. So an obvious course is to put up additional dams of higher heights and capacities, to regulate the habitation of the people in the flood zones, to convert houses to pucca houses with at least high plinth. All these mean more money. But this expenditure in time will be at least a Fixed Asset for the country, and a relief to its people, than wasting crores of rupees on eradicating the ravages of floods after the floods are over. After the flood the administration and the planner can dole out kgs of food and brick, but cannot bring back lost life or a broken up or erased family.

It is thus absolutely necessary that a re-thinking on planning river valley projects as to be done, with the objectives of increasing the holding capacity of rainfall aters, arranging extent and timing and diversionary passage of the outflow of dam aters, regulating the habitat of the flood zones, and improving the drainage of the at areas, building of pucca houses with high plinth near flood zones.

It is also abundantly clear that existing layout of old villages do not meet the quirements of the time or of the floods. Where villages have been completely ashed away they have to be built on newer modern concepts, and damaged villages so have to be reconstructed complying as far as possible such newer concepts.

It has been repeatedly seen that after heavy floods, as in 1942 in Bihar-Bengal order, and in 1978 in West Bengal, heavy silting with sand occurs in the flooded gricultural fields, rendering temporarily agriculture impossible, reducing temporarily e acreage under cultivation. Hence reclamation of further areas is a necessity.

Sunderbans lying within the district of 24-Parganas in the southern part of Vest Bengal has great potentialities for increasing 1) agricultural produce and 2) evelopment of industries and other activities related to raising the living standard f our people. The expanse of Sunderban area is about 3089 sq.miles, of which 629 sq.miles are under reserved forests, with about 732 sq.miles covered by creeks nd channels. Of the remaining 1460 sq.miles reclaimed from forests, about 1000 sq. iles are under cultivation. The fertility is high and the texture of soil consists of ne clay and silt brought by the rivers.

The development of the area is dependent on the extent of strong protection gainst inundation by saline water from the sea. Once the problem is solved, the evelopment of agriculture and industry will follow rapidly. Such reclamation has een carried out in Netherlands through a system of dykes.

Before the 12th century the Padma which now carries the main volume of the Ganga waters, was a small spill channel, the present course of the Bhagirathi-Hooghly being the main course of the Ganga. Between the 12th and 16th centuries, he Ganga flow was divided between the Padma and Bhagirathi channels. But from he 16th century onwards, the main flow of the Ganga is passing through the Padma. With the diversion of main Ganga towards Padma in the 16th century, all the rivers of the 24-Parganas except the Hooghly and the Ichamati, were deprived of the head water supply. Hooghly and the Ichanmati receive such supply only during the monsoon months from Ganga.

These rivers accordingly are now more or less tidal channels, and hence new and formation is now entirely dependent on tides. The entire Sunderbans is now

interwoven with innumerable such channels, big and small, and which also serve as drainage channels of the area. Considering that the annual rainfall of the area is normally only 60 inches, most of which is concentrated in the two and a half months of with the monsoon period, these channels are important for discharge of monsoon waters. So any scheme of protecting the area should require the construction of dykes, not only along the sea face, but along these channels., which also helps in reclamation of lands, and prevents flooding of surrounding areas.

New land formation starts when there are sufficient fine alluvial deposits. The not strong enough currents from the sea helps growth of sea plants, and the peaty formation caused by further alluvial deposits enriches the soil. This is thus a proper time for putting the dykes system. At present 2200 miles of embankment exists for protection of about 1000 sq.miles of cultivation lands, but off and on breach occurs, resulting in damage to farm lands annually. It is difficult to maintain the 2200 miles of embankment peoperly. Hence as in Holland, with the help of a system of dykes at sea face, these embankments can be reduced to 300 to 400 miles. But comparison with Holland has limitation as to nature of soil and nature and extent of rainfall. Our irrigation engineers have to look into our problems of dykes and embankment systems in our own way.

Further, heavy denudation of the foot hills of the Himalayas over the ages, coupled with human depredation in denudation of forests have been causing the carrying down of silt from the catchment areas of big rivers like the Ganga and the Jamuna., to the estuaries near Sunderbans, resulting in heavy deposit of fine silt over the centuries, at the mouth of the estuarine basin of West Bengal. New lands are therefore expected to emerge near Sunderbans, which may even be vast tracts in the near future, fit for conversion to forests, extension of Sunderbans, and in subsequent years for partial reclamation for agriculture and habitation. Great attention has to be devoted to this aspect, and which requires constant aerial and stationary space satellite survey.

Space observation has come to importance these recent days. Data obtained with the help of the photography or TV tracking, provide us with information on the distribution of cloudiness, snow and ice cover through out the globe. Investigations of the cloud cover are of particular interest on the shape and amount of clouds. The structures of the fields of cloudiness permit us to judge the character of the processes occuring in the atmosphere. It means that the observation of the shape and amount of clouds helps to forecast the change of the weather as a whole. It is possible and important to watch the evolution of clouds and cloud covers over the enormous territory in India, with the help of the so-called 'Stationary satellites' of the earth, launched into

equatorial orbit with an altitude over earth's surface of about 36,000 kms, and vith angular speed that equals to earth's. With the help of such 'Stationary atellites' it is possible to determine the upper boundary of clouds, the temperature of earth's surface, the velocity and direction of wind at different altitudes hrough stereoscopic observations. Radio-meteorological investigations are possible on cumulus congestus, on strato-cumulus in the cyclone system over he ocean surface. It is also possible to investigate on Cumulus humilis and Cumulus congestus in advance, where there is intensive development of cumulus congestus upto altitudcs of 5 to 10 kms, that produce heavy rains.

A second group of clouds inciude the clouds connected with the existence of cyclones, that is the earth regions over which there are areas of low atmospheric pressure. Studies can be made of vertical air movements of warm and cold flows in the cyclone system, divided by the so called atmospheric fronts, eold and warm. The difference of thermodynamic properties of air masses near these fronts, that cause tbe formation of euormous cloud masses, stretching many hundreds of kilometres, can be studied in advance, and warnings taken.

Studies can also be made of third group of clouds which is formed in the atmosphere over large geographical areas with strong winds steady in direction, and whose velocity reaches several hundred kilometres per hour. When the air fluxes are so strong, the could banks are located in peculiar rows stretching for many kilometres. These studies of Cumulus humilis, Cumulus congestus, Cumulo-nimbus, and Alto-stratus, Cirrus, Cirrro-stratus and Strato cumulus of the cyclone periphery can be studied continuously in detail along with frontal multilayer clouds. and on spirality in location of Cirrus and Stato-cumulus, the latest weather study methods of science.

From all the above you will have seen that this Society of yours is in the wide possession of technological aspects of floods, flood relief, village planning, regional transportation, and power planning, weather studies, agriculture and Regional planning, not to speak of Housing, and on Metropolitan planning on a high level basis, on transportation and industrial planning and on evaluation studies. In fact your wide range of members have such varied experience and expertise that they can assist our country and administration in a variety of useful ways. Hence your Society is ever ready to help the State on all important aspects of planning, technology, engineering and science, on science of better living for the masses of India.

During the last few years, we have been constantly sending to Government of India and ta State Governments our Recommendations on Studies on various subjects, like agriculture, power, transportation, housing and the like.

As your Honorary Secretary's Report may have shown, we have tried our level best to assist from the Society's side the flood striken people, and as regards the aftermath of floods, in reconstruction works. We stand by the Government and the people in both planning advice, and in execution of works of reconstruction, and in providing funds.

In fact your Society is not only equipped to assist the country in respect of the flood striken. It is well equipped to assist the reconstruction and development of the entire country of India, a work over which no other work is more cherished.

In Engineering Science and Technology, we have been publishing in recent years high level papers on engineering, technology and on science, that I am sure, is attracting the attention of the world. Your Journal has obtained its mark, it has the stamp of originality of thought, and its endeavours to disseminate this knowledge over the world is praise worthy. I remember how, some years back, the American front rank Technology Journal, 'Tools' was attracted by our Journal, and invited us to write a Guest Editorial in their Journal, which we did. It was a high prize for our Journalism and journalistic endeavour. Mention can be made of late Dr. B. N. Dey's Editorial too in the said American Journal's comment. We have continued to show and follow the same steady path in our Journal 'Science & Engineering,'

You have also seen from our General Secretary's Report how our financial position has improved. This is entirely due to the indefatiguable endeavour of our honorary General Secretary Mr. Sarat Chandran and Joint Secretary Mr. P. K. Chaudhury and Mr. S. M. Sarkar and our immitable and erudite Honorary Editor Mr. D. K. Das, to our devoted band of staff, and last but not the least to our members far flung in the globe, and to our valued colleagues and members of the Executive Committee, whose wisdom has helped me at every step and been slowly leading the Society to the high path of progress and expansion.

We are accordingly planning for our own Society's building, planning for establishing more Centres in important cities of India, and even in USA and in other foreign countries.

In our MARCH FOR PROGRESS in the fields of Engineering, Technology and Science, we have not forgotten our working engineers,. We are improving our Rules and Regulations, and following a path that will give your Society a high level status in the world, above what we possess now. In our March to Progress, we take endeavour our country and our people along, aim for their good and happiness, and all co-operation for our administration.

I thank you all.

HOUSING : AFTER THE DELUGE

Dr. B.N. Dey Memorial Lecture delivered by Shri Narayan Sanyal, B. Sc., B.E, F.I.E, Liason Officer, Eastern Region. N.B.O. Govt. of India, at the Annual Social on the occasion of the 44th Annual General Meeting of India Society of Engineers on November 25, 1978.

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1. Introduction

1. That we are facing a serious housing problem to day needs no reiteration. It is aggravating year after year. Taking the requirements of dwellings alone for the entire country, it is estimated that we need to build some 15.6 million houses—3.8 million in urban areas and 11.8 million in rural. It is also estimated that the expenditure required for wiping out from India the shortage of housing, both in urban and rural areas, would be of the order of Rs. 73,400 millions, considering on a modest scale the cost of an urban house at Rs. 10,000/- and that of a rural house at Rs. 3,000/-

1.2. It has been projected that by the turning of this century our population would have been swelled to some 1000 millions, from the present day level of about 600 million. Unless a massive effort is made to build houses at the rate of at least 10 dwelling units per thousand of population (the present rate is only 3 to 4) the country's gigantic housing problem may assume the form of a national crisis.

1.3. These nation wide problems are known to the experts and they are finding ways and means to solve them. We are here, today, to consider the localised problem of West Bengal, more so in the light of our experience of the recent floods. For us, it has already become a national crisis especially today, in this aftermath of the deluge.

2. Objectives :

Admittedly, the flood of this year is the news of the Century, and we may reasonably expect that the magnitude of the calamity would not be repeated in decades to come. Nevertheless, permit me to quote from the "Recommendation for National Action" as adopted in the Vancouver conference of HABITAT (United Nation's conference on 'Human Settlements from 31st May to 11th June 1976—recommendation in para B.14, chapter II) :

II) "Planning for Human Settlements should avoid known hazards which could lead to natural disasters. The planning of reconstruction after natural or man-made disasters should be used as an opportunity to improve the quality of the whole settlement, its functional and special pattern and environments in particular by :

(I) Improving the technologies to forecast and miligate the effects of disasters ;

(II) Providing for predisaster traning in disaster-prone areas ;

(III) Establishing agencies with adequate authority and skills to undertake the immediate relief and long-term reconstruction of the whole settlement of the area ;

(IV) Providing for the basic needs of the affected population, especially the temporary or parmanent relocation of survivors, and the involvement of survivors in realated plans and programs ;

(V) Providing for a National Disaster Fund ;

(VI) Co-ordinating the use of all local, national or international resources for prevention and reconstruction ;

(VII) Learning from the lessons of similar experiences for planning before, during and after disasters".

Most of these recommendations are meant for the administrators. But we engineers have some responsibility in helpping the Govt. in taking such action.

First, we cannot carry out the instructions contained in the very first line—we have no means to avoid this known hazard in our overpopulated, truncated, riverine State and ask the flood-sticken millions to choose better dwelling sites. Since the disease cannot be cured by avoidance it must be endured as best as we can.

2.2. The magnitude of the annual floods may vary but it cannot be denied that, due to silting up of the rivers and continious raising of embankments, this riverine State is now in constant danger of such annual devastation. In fact, floods big or small is an yearly feature in some blocks of Midapore, Burdwan, Nadia, 24 Parganas, Murshidabad, Maldah, Cooch Behar etc. We should, therefore, think twice before reconstructing the damaged habitats in the traditional way. Admittedly, we have no breathing time to think twice, considering the precarious condition of homeless millions. This has in fact, prompted me to choose this suject-matter for the annual gathering today while paying homage to our most illustrious big brother, Late Dr. B. N. Dey.

2.3. Our discussion would be divided into two broad branches—Rural Housing and Urban Housing in flood prone areas, each being again subdivided into a few sub heads—building materials, plans, techniques agencies etc.

3. **Urban Housing** :

One may argue that discussions on construction of multistoreyed houses in metropolis like Calcutta, Howrah, Durgapore etc. should be out of our scope. But they are not. Simply for the fact that building material' and 'financial resources are two of the main stumbling blocks on our path and, therefore, we cannot ignore

such construction activities. If we cannot economise the urban housing activities. spare cement, steel, bricks and money for our hetherto neglected rural counterparts we cannot expect to make much headway.

3.1 **Resources Limitations :**

The financial constraints and inadequacy of materials, skilled labour etc, are limiting factors, in launching large scale country wide housing programmes. It is necessary to think in terms of stretching availabie sources' ; in other words, to make the best use of available men and materials to put up the largest number of houses which are are at the same time satisfactory from the point of view of safety, comfort and durability. In doing so, research and new technology become big assets.

3.2. **Research & Development :**

The National Research Laboratories, iike the Central Building Research Instltute at Roorkee, Structural Engineering Research Centre, Madras, Cement Research Inst, New Delhi and other laboratories as set up by the various State Govts have played a useful role in evolving a number of cost and time saving techniques and materials which are finding increasing application in Sister States. The National Buildings Organisation under the Works and Housing Ministry was set up by the Govt of India in 1954 to tackle the housing problem at a national level in a comprehensive manner. It undertakes activities and studies aimed at ameliorating the housing conditions. Among its manifold activities, the transfer of research results and technology from the 'know how' of laboratories to the 'show how' of construction sites is an important one. The 'Experimental Housing Scheme' operated by the N. B. O. has been conceived with the objective of demonstrating and evaluating new techniques/ materials evolved by research development organisations/institutlons on the constru-ction site.

3.3. **Experimental Housing Scheme of N. B. O :**

This scheme was instituted by the Govt of India in 1962 and N. B. O has been entrusted with the task of administering the scheme by providing grant in aids to the P. W. D, Housing Boards and other construction agencis who sponsor experimental projects incorporating new materials/techniques and cost saving devises ; or proposes to execute on experimental basis any new technique already recommended by the N. B. O. The aid given generally covers the cost of experimentation or guarantees the enterprising organisations for any financial loss in adopting the techniques already approved by the N. B. O (Details of this scheme is availableat the liaison Cell Office of the N. B. O located at 76 Dr Sundari Mohan Avenue 4th floor, Calcutta-14) The estimated cost of the projects taken up so far amounts to Rs. 1.64 crores Permit me to mention that till date very few proposals have come from West Bengal.

8.4. **Achievements so far :**

Over 41 new techniques and materials of construction have so far been incorporated of which some major ones are shortly discussed below. The Liaison Cell of the N. B. O. Eastern Region is awaiting to explain to inquisitive engineers about the technical details :

3.4. 1. **New Techniques & Materials :**

(A) Flooring and Roofing : The following precast roofing flooring techniques which have the manifold advantages of savings in cost, consumption of cement and steel and increase pace of construction are shortly described below. All these precast roofing/flooring systems make use of components which are fabricated on ground ready in all respects for erecting in the building. In all these systems, in situ concrete work is minimised, so that it will not seriously affect the speed of construction. The time consuming paraphernalia of stuttering and centering etc. is completely eliminated.

1) **Precast Channel Units :**

These are cast with the help of well prepared timber or steel moulds. Each unit is generally 30 cm wide suitable for span, say 30.cm and weighing only about 170 Kg. Bigger channels, if required, could also be prepared. Lateral transmission of load is effected by horizontal and vertical keys, forming a monolithic slab. The grooves are filled up with in situ cement concrete of grade M-150. Expected savings are : steel 20% ; cement 25—30% ; overall cost 15%

II) **Cored Units :**

The units are precast in moulds of the requisite size in which smooth surface pipe sare inserted at the time of casting. After the moulds are filled with concrete, the pipes are withdrawn at a specified time so that they leave circular hollow cores along the length of the cast units, properly reinforced with steel. Unlike the channel units, this have flat surface, providing good thermal insulation to the roof. The actual savings found—cement 20% ; cost of root 5 to 10%

III) **Precast Waffle Shells :**

The main advantage here is that this could be designed as a two way slab, generally square with sides 60 cm and thickness of 2.5. cm Bigger size if needed, can also be prepared. Shell units upto 1.5m × 1.5m can be handled manually.

iv) **Precast Cellular Units :**

In this system, hollow cement. conc, unreinforced units, termed 'Cellular Units' are supported on fully or partially precast thin R. C. C beams. A unit 1200 × 600 × 75 mm weights 80 kg and 4 cellular spaces are provided A unit

with three spaces has a dimension of $1000 \times 500 \times 100$ m.m and 55 Kgeighs. The adoption of precast cellular units roofing/flooring system could affect 10 to 20% savings in the consumption of steel and 20% in cement with overall saving of about 10% in the cost of construction.

v) **Precast Hyperboloid shell Roofing :**

Found sucessful in industrial buildings, airport hangers etc, necessitating large span planning. The main advantage of this system is in offering unobstructed room areas by avoiding intermediate columns. This is not recommended for normal residential houses.

vi) **Precast Batten and Hollow block construction :**

This is almost similar to 'Cellular Units', instead of concrete cellular units, hollow blocks of concrete are supported on suitably designed 'T' battens and furnished with topping concrete. Erection is very simple in this system also. The 'T' battens are placed on the wall with gaps between them equal to the width of the hollow biocks, placed on the battens close to one another to fill-up inter-space. It assures savings in steel 5% ; cement 10-15% ; and overall 10%. Good thermal insulation is also obtained beneath the roof slab because of the air spaces in the hollow blocks.

I crave your permission, Gentlemen, to pause here and submit that although the above system have been abundantly used in the Sister States—both in the public as well as in private sectors, none has, at least as my knowiedge goes—been seriously tried by any of the Govt. Directorates in West Bengal. I take this opportunity to mention that Dr, Kalyan Banerji, the eminent structural engineer has adopted 'Channel Units' and 'Precast Batten and Hollow Block Construction' using jhama as course aggregate instead of stone-chips in a large number of multi-storeyed construction in Calcutta itself. He has given me to understand that his overall savings was about 12% in these multi-storeyed housing projects totally costing over 5 crores.

It may also be mentioned that use of these precast roofing systems requires special emphasis e.g. on the planning of the building, for ensuring satisfactory results. It is desirable that the building plan should be prepared keeping an uniform span to economise use of precast units of specified length. But then these have additional advantages not yet mentioned. For example, in repetitive type standard buildings, like Primary Schools, Primary Health Centres, Family Planning Centres—mostly executed in the deep interiors, if often becomes extremely difficult to ensure proper supervision, curing etc. If precast units are manufactured at the district or sub-divisional head-quarters and then carried to site in trucks or bullock carts (instead of carrying stone-chips, cement, steel,

shuttering and centaring materials—none of which is locally available) we can ensure better workmanship and supervision in addition to saving on transport item. Casting with concrete mixers, vibtrators or ensuring slum-test or seive test etc.—let us be frank amongst ourselves, Gentlemen—are hardly possible in such individual sites 'far from the madding crowd' !

(B) Superstructure Walls :

For multi-storeyed brick-built houses in West Bengal, it is customary to construct thicker walls in the lower floor as per thumb rule evolved by our predecessors. For example, in a 3 storeyed building in and around Calcutta we resort to 15", 10" and 10" walls in ground, first and 2nd floor. In a 4 storeyed house we construct 15", 15", 10" and 10" walls, The C.B.R.I. and the N.B.O. had proved that with the bricks available here one can construct even a five storeyed building with 10" thick walls right from the ground floor to the fifth. Shri R. B. Sen, the then Commissioner of the West Bengal Housing Board, readily accepted this and under his orders scores of such multi-storeyed buildings were constructed by that organisation. Housing Deptt., C.M.D.A., and Howrah Improvement Trust have also saved considerable amount of the public exchequer by adopting this system which we call 'one-brick-thick load bearing walls'.

Calcutta is unfortunate as we do not have building stores or lime quaries in the neighbourhood Admitted. But Mother Ganges has partially compensated the loss by offering bricks having the highest crushing strength in India. If we Calcutta engineers prove ourselves unworthy in acceping the boon of the Mother Ganges whom are we to blame ? Yet, unfortunately, a large number of the engineering directorates of the Public Sector have failed to make good use of this discovery, notwithstanding the fact that more than a hundred such tall houses are standing in Calcutta itself.

(C) Modular Bricks :

Although a number of sister states have suitched over to the modular measurement of bricks—started manufacturing them in large scale and have changed their working schedule accordingly, we in West Bengal, who find a pride in quoting Gokhale's "What Bengal thinks to day"......etc. could just hold a few meetings, discussion and seminars. In such a scminar arranged on 30-9-77 at the Birla Technological Musum, presided over by Shri R. B. Sen and attended by a large number of engineers/architects of both private and public sectors as well as a large number of brick manufactures, everybody agreed that adoption of modular bricks would be economical and advantageous. The engineers said that they do not specify modular bricks in the drawing schedule because

these are not available in the market. The brick field owners, on the otherhand, complained that they do not manufacture modular bricks as these are not specified by the engineers in their drawings/schedules. Obviously, this ts a vicious circle. Admisted. But what is the remedy ? The local representative of the N.B.O. issued a cyclostyled circular amongst the leading consumers of the public sector, asking for anticipated requirement of modular bricks in the next season with a view to convey the message to the brick manufactures. But, unfortunately, the response was extremely poor—practically nil. Two brick burning seasons have since passed. We are at the very door of the 3rd. Can we do something ?

(D) Thin precast R.C C. lintels :

The N.B.O. has evolved methods by which 75 mm. thick lintels would be adequate for a span of 1.75 m. with normal loading. No. dapartment to my knowledge, has yet adopted this technique in West Bengal.

(E) Precast R.C.C. frames for doors/windows :

The cost of woodwork has gone up considerably and the N.B.O. has suggested a remedy by introducing R.C. frames of 60 x 100 mm. or 70 x 75 mm for single shutters and 60 x 120 mm for double-leaf-shutters. This ensures economy, The W. B. Housing Deptt. executed this type of work and found it both satisfactory and cheaper.

(F) Jhama as coarse aggregate in R.C.C. work :

Stone-chips being a costly building material the private sector has adopted use of Jhama chips in intermediate R.C.C. floors. Jhama is more porous than stone-chips but with proper treatment can very well be used in the intermediate floors, But this is not done by public sector even in unimportant buildings although the private sector is using this abundantly.

3.5 **Why this apathy ?**

You may pertinently ask me, if these are really economical and advantageous, why are they not being widely implemented in our State ? Well, I would like to put the ball in your court and ask you the same question. That these are (if not all of them in our local conditions) mostly economical and advantageous, have already been proved in sister states, and some in our owns state as well. This is an established fact. It is also a fact that these are not being accepted by the engineers at the helm of affairs. I have tried in my own small way to find out the root cause. I have personally contacted a few dozen eminent engineers of the public sector in West Bengal, Bihar, Orissa, Tripura etc ; and my findings show that the cause is often not objective but subjective. These are :

i) **Lack of enthusiasm :** Most of the high placed engineers in the public sector are grey haired, like me. To quote Bertrand Rusell. "A man dies at the age of twenty six and for the rest of his life he chews the cud".

ii) **Fear complex :** With an undefiled service-career leading him to the post of top executive, he fears now to take any risk, whatsoever, at the very door of retirement.

iii) **Conservatism :** Sincerely believes that our 'forefathers' were better engineers and no new scientific discovery would change the age-old traditional techniques.

iv) **Selfishness :** 'Such national savings would not accure to me or to my organisation any financial gain ! So what the hell do I care' !

These remarks may appear harsh, and certainly do not reflect the mentality of the majority, who, I am sure, are only sceptic considering the added responsibility them would have to shoulder. To such engineers my appeal is that they should go through those literatures, make small experiments for their own satisfaction (I repeat, that the N.B.O. would stand guarantee for any loss in such experiments) and then come out as engineers worth the name by saving the national wealth.

4. **Rural Housing :**

4.1, About 33 million people live in rural areas in West Bengal scattered in about 33,000 villages, They live, according to census, in about 5½ million of huts, the majority of which are below the expected standard of rural habitats. These are broadly divided into four groups according to their size, specification, as well as the economic status of their owners ; namely :

i) high income rural folks.

ii) middle income groups.

iii) low income groups.

iv) landless and houseless agricultural labours.

The first category belongs to wealthy farmers having large holdings ; the second category belongs to the 'jotdars' and people of other trades having moderately good income. Habitats of these two categories are tolerably good and we may, in our discussion, apart from flood victim consideration, exclude their cases. The third category have been completely neglected in Rural Housing Schemes undertaken since or prior to independance. I shall discuss their cases later, to give prominence to the last category, who have suffered most.

4.2 **House for Landless Agricultural Labours :**

After long neglect the State Govt. took up a scheme in 1976-77 for offering free houses to the landless labourers only (without any consideration of the other categories of rural folks) whose number had doubled in the past decade, by adopting a Crash Programme out of 20-point drive of the then Prime Minister Mrs. Indira Gandhi. Construction of 40,000 huts at Rs. 500/- each was taken up in November 1976 and completed by the district administration before the general election in March '77. The exact position of these completed huts is not known, but there is reason to believe that the result was far from satisfactory. It is apprehended that :

i) A considerable number of huts completed and handed over free to the beneficiaries were never occupied.

ii) Some huts, though completed, could not even be distributed, though offered free of cost—there were no one to receive them :

iii) In some cases some sort of roof was placed on bamboo posts with no outer walls to arrive at the target number of huts within the crash-programme time scheduled during "Emergency".

iv) Considerable number of huts could not stand the first nor' wester.

Gentlemen I have no intention of vilifying any person, institution or authority, but I prefer to put this information on record at the eve of another such emergent scheme. My intention is to impress that budget expenditure in target time is not the criterion to assess our achievements. The field officers cannot perform miracles if only money is handed over to them after getting grants from the Central Government. In 1976-77, no plan was prepared, no specification was prescribed and the results have been most unsatisfactory. Let us not repeat the same by asking the admintstration to perform miracles

4. 2. 2. Next year, that is in 1977-78 the Agri & C. D. Deptt. launched another programme of Rs. 15 million for construction of huts for the landless people through the district administrative authorities. This time the ceiling cost per hut was raised from Rs. 500/- to Rs. 1,000/-for normal areas and to Rs. 1,5 0/-for the hilly areas in North Bengal and Sundarbans. Again although the minimum floor area was specified no "Rural Housing cell" with engineers, adopt in rural housing, was created. The plans and specifications were left to be finalised by the district magistrates. The work is in progress.

4. 2. 3 Such schemes can succeed only when geared by a centralised unit consisting of experienced engineers. In sister States there are 'Rural Housing Deptts., but in West Bengal no such organisation has yet been set up. This should be done forthwith, with specific duties, such as

i) Preparing zonal plans and specifications
ii) Chalking guide line policies, arranging coal for burning bricks etc.
iii) Collecting data for future programme in Rural Housing work etc. (Incidentally a 'Rural Housing Wing' opened by the N. B. O at B. E College, Sibpore is doing such work. No such attempt has yet been taken by the State Goyernment).
iv) Supervising the work done by the district administrations

4. 3. **Low income group rural folks :**

It is unfortunate that though there are Housing Schemes for helping low income urban people nothing has so far been done for the same category of people living in villages. Due to the increase in price of agricultural commodities such low income rural folks often have Rs. 20/- to Rs. 30/-as surplus cash per month. This is not adequate for house construction. They buy torches, bicycles and possibly transistor or terryline shirts. Such people do not need any exgratia financial help, but certainly they need finance in the form of loan like the L. I. G. of the urban area. If there be a Rural Housing Board' there is no reason why West Bengal cannot construct such rural huts on hire purchase schemes as has been done in Maharashtra or Tamil Nadu with loan offered by the HUDCO. The cost of such huts may very from Rs 2,500/- to Rs. 3, 500/-each, excluding cost of land. The plinth area and specification may conform to the norms prescribed by the N. B. O. and C B. R. I. We may have several Zonal plans prepared by the 'Rural Housing Board' giving the benificiaries the opportunity to pick and choose. A brochure in Bengali, describing the scheme and showing the plans may ba prepared and circulated amongst the rural folk through the B. D. O.S, giving publicity through other media. But all these need a separate 'Rural Housing Board' in the state to start the work.

5. **Rural House In Flood Affected Areas :**

We have at long last come to the crux of the problem. It is learnt from the newspapers that scores of alternative plans and designs have been prepared by the experts and these are under consideration, or possibly under execution by now. It is not possible to prescribe one or two standard plans, because the building material available at Maldah differs widely from that at 24 parganas or Midnapur, although the rivers in spate act with almost equal fury. We may just pen down a few guiding factors and offer a few suggestive broad line designs, leaving the finallsation to local people.

5.1. **Guid ine principles :**

i) Attempts should be made to use as much local material as possible avoiding costlier materials. The technique should be such as not to require adept artisans.

ii) The huts should be repairablle by villagers themselves

iii) In such-flood-prone areas the public buildings, like Primary Schools, Health Centrhs, Panchayet Office etc. should invariably be built on pillars as discussed in para 5.4.

iv) Raising of plinth means additional expenditure—but each hut must have some high storage space to keep valuables at the time of flood.

v) Except for fhe lowest income groups (whom we cannot just afford to provide) all huts may have flat pre-cast roofs on strong brick-pillars wiih arrangement to take shelter on the roof.

We may now discuss a few typical examples :

5.2. **Growing Shelter for Flood-Victims :**

5.2.1. This is a minimum shelter which can grow up into a full scale house in future, when, after possibly a few harvesting seasons the villager may afford to add a kitchen in the front, or a room at the back. He may also improve the walls by adding sun-dried or burnt bricks to replace the laminated walls.

5.2.2. It consists of a single room 11′ 0″x9′-0″ (I purposely mention F.P.S. units to make it comprehensible to villagers) with a bit higher plinth (2′-6″) to give him a breathing time in case of incoming floods. There are split bamboo shelves at 6 -6″ or higher levels to store valuables (land records, papers, cash, ornaments, clothings, idol etc.) in case of normal floods. The skeleton is brick-built in mud.morter with laminated wallings in between. The roof may be of thatch or tiles, as found convenient. This hut is suitable for floods not exceeding 5′ or 6′.

5.2.3. If the unskilled labour is paid from 'food for work programme' such a hut would cost between Rs. 800/- to Ss. 1 000/-

5.2.4. It may be noted that the walls are 8″ (200 mm) thick, built in mud-morter in a new type of bonding explained in para 6 below. If it becomes difficult to execute this type of bondIng, one-brick (10″ or 250 mm) walls may be resorted to. The 'laminated wall' may be mooly walling, darma, split-bamboo, daub walling etc, depending on the locality. Such laminated walls could be substituted in future, gradually without disturbing the roof. It may also be noted that there is one layer of 10″ course (in case of 8″ walls) or 15″ course (in case of 10″ walls) 3″ below floor level to hold the laminated wallings, hung from top.

5.2.5. I may add one more point : Even if our funds permit we should not try to complete the entire walling in brick-work. This is only to help constructing a larger number of huts with the number of bricks available at each locality.

5.3. **One-room hut with kitchen and verandah :**

5.3.1. This hut consists of one room (12′ x 9′) one kitchen (6′x5′), and a varandah space (5′-10″ x 3′-10″) for serving meals. The plinth is again 2′-6″ to give a breathing time on signal of incoming floods. The skeleton of the house is on burnt brick-work in mud-mortar with laminated wallings resting on the string course. There are high level bamboo-racks for storing valuables in times of flood.

5.3.2. The additional feature is precast 'batten and hollow-blocks, as described in para 3.4.1, A. VI, using Jhama as course aggregate. Precast concrete rings 10″x5″x3″ may be inserted on the walls as shown in the drawing, allowing escapade of the inmates at the time of flood. The parapet pillars may be used as structs for bamboo-poles at the peak hours of the flood. Inmates can survive even when the flood-level is as high as 12′-0″ (shown in drawing).

5.3.3. Again we have shown construction in 8″ (200 mm) bonding using ordinary clamp-burnt bricks in mud-morter as per technique explained in para 6, below. If the local masons cannot construct such bonding even after explanning the technique, normal 10″ thick walls may be constructed. At the cost of repetition, it is mentioned that the entire house may not be constructed with bricks, considering the limited supply of bricks in each locality, but the spaces in between pillars may be filled up with laminated wallings (mooly, darma, spit bamboo, Jhatimati, daub etc. as is the local practice)

5.3.4. Cost of such a house would vary between Rs. 3,000/ to Hs. 3,500/- for which loans may be arranged.

5.4. **Primary School in flood brone areas :**

5.4.1. The plan of the building follows the norms approved by the D.P.I.

The suggestive changes are only in the elevation :

i) The entire building may rest on pillars 2.2 m high with a very low plinth of only 150 mm, Classes may be held at first floor level (2.2 m above gr.) and the lower covered-space may be utised 3 months in a year for community purposes. During flood and monsoons it will be submerged.

ii) The class-room level is accessible by a ramp (not stair) as shown in the drawing. This floor will shelter cattle, women, children and older people at the time of flood.

iii) Able-bodied adults would take shelter in the roof (5.4 m) with the help of a ladder and rings embedded in brick work. The last rung of the R.C.C. ring should be above the reach of the children at the class-room level.

iv) To economise carriage of stone chips etc the pillars are proposed with clamp burnt local bricks in cement morter. If R.C.C. pillars be found more economical in any site this may be resorted.

v) It may be noted that this two storeyed building with precast 'batten and hollow blocks' costs about Rs. 25,000/-

vi) Such public buildings could shelter the human victims and cattle at the time of emergency.

6. 200 mm Wall with Normal Bengal Bricks :

Before concluding let me place before you a new technique in brick-bonding which could produce 200 mm walls with advantage, as has been shown in the working drawings. Though this is in the process of getting approval of the N.B.O. it has already been adopted in a large number of multistoreyed constructions in Calcutta with excellent results. I take this opportunity to place before you the case :

6. 1. With little variation a standard Bengal brick measures $239 \times 119 \times 69$ mm. It is curious to note that the length of bricks in Delhi or North India is lesser that in W. Bengal. The reason, as it appears to me, is that the engineers of by gone days in this lower Gangetic region felt that due to heavy rainfall in this area thicker walls are desirable to resist moisture. They, therefore, increased the length of the bricks so that a normal outer wall is 10 "thick and not 9" as in North India. Even today some eminent engineers in Calcutta argue with me that 200 mm modular bricks are not suitable in this climate. Engineers holding such opinion often show me some 250mm think wall that falled to withstand soakge of water.

6. 2. But then it is not the thickness of wall that resists water percolation, but the quality of brick and mortar, particularly the technique of bonding which does not allow any vertical break-joint in the header course for a one-brick wall, whether in English Bond, or Flemish Bond.

6.3 This new technique in bouding is tried with traditional $10'' \times 5'' \times 3''$ bricks to produce 8" (200 mm) thick outer walls avoiding header course altogether, i.e. ensuring break, joints at each horigontal layer. This has been shown in the sketch attached. The theoretical size of bricks has been assumed as $10'' \times 5'' \times 3''$ as normally considered in Calcutta. In this new bonding technique as the header course is avoided, water cannot pass through any brick,if it be porous, under burnt

or defective. There are, however, through and through mortar joint at every $10\frac{1}{2}''$ hight. The advantages of this new technique can be summarised as below

i) Consumption of bricks is reduced by 20%

ii) Consumption of mortar is reduced by 20%.

iii) Chance of dampness is reduced, as there is no layer where water may soak through defecteve bricks in header course as is inevitable in other bondings.

iv) The chance of seepage through week or defective mortar joints is minimised by 66%.

v) Both faces being even, no 3/4" plaster is necessary as is inevitable in the inner faces of one-brick thick walls in other bonds and considerable saving is made in plaster item.

vi) Dead wt. of walls is reduced by 20%, causing economy in designs of beams, slabs, columns, down to the foundation.

vii) Such 200 mm walls may not take the load of storeyed building, when one brick thick load bearing walls are contemplated. That naturally depends on the planning and crushing strength of the bricks.

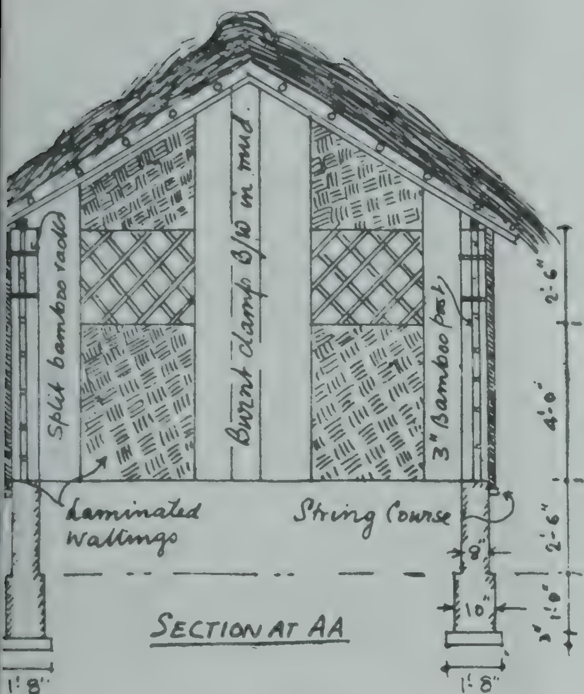
viii) But such 200 mm walls have been found excellent for framed buildings where the outer walls do not carry superimposed loads but protects the inmates from the inclimancy of weather.

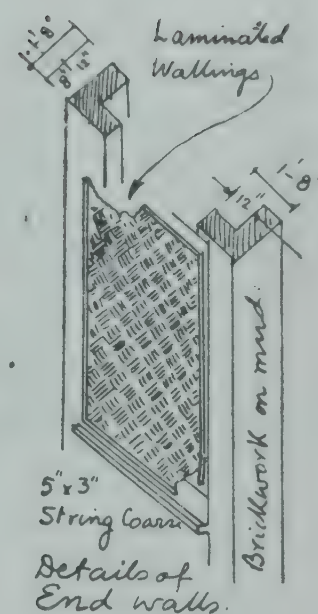
ix) The insullation effect is practically the same as that of a 250 mm walled room. No appreciable change was noted.

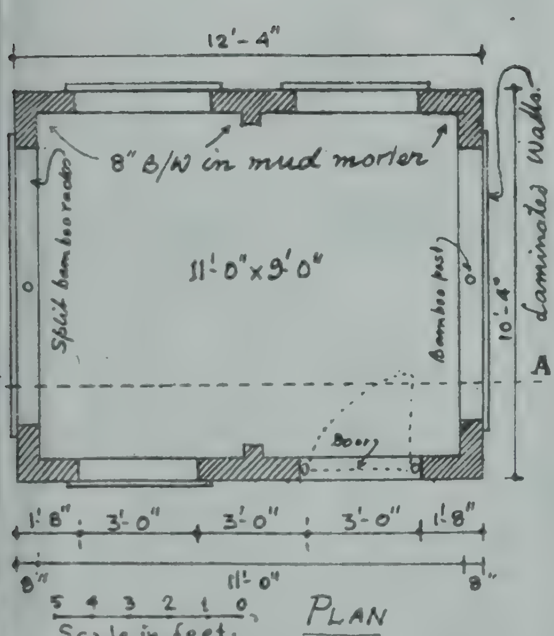
x) The difficulty in boading when a 75mm wall joins the main wall is avoided in this bonding as the beds correspond at every $10\frac{1}{2}''$ height. This advantaga does not exsist in normal 250 mm walls.

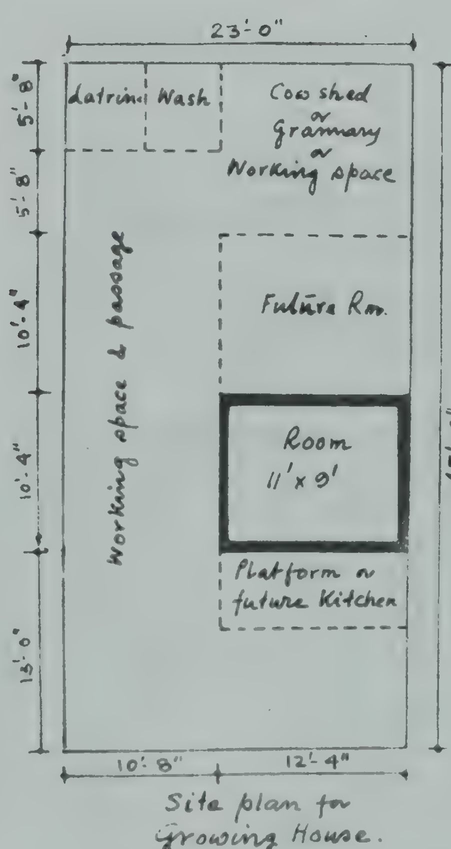
xi) Initially the mason may claim some extra labour charges but after practice they have been seen to produce the same amount of wall-surface in 200 mm walls as in normal 250mm bonds.

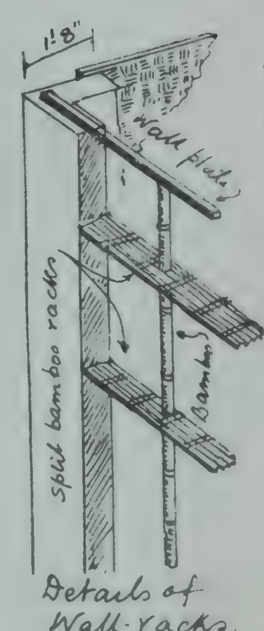
xii) For storeyed buildings the mason may produce the units of 5 bricks in blocks, measuring $10\frac{1}{2}'' \times 10'' \times 8''$ and cure them properly operating on ground level. The labourers (even female workers) can carry the 'units' consisting of 5 bricks for quick execution after the roof is cast. This saves much time. Will you, genttemen, try this new bonding and see if I tell the truth ?



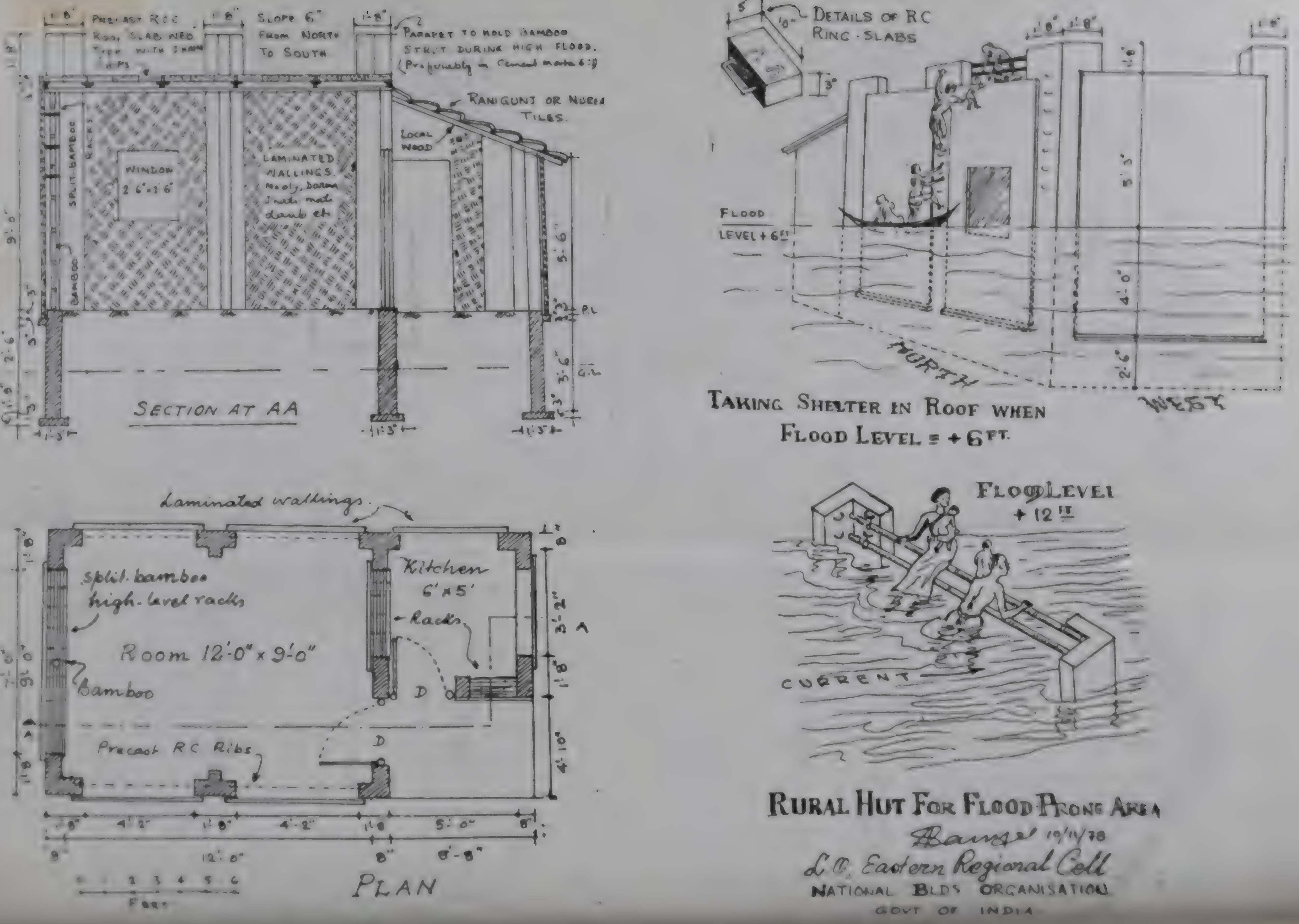


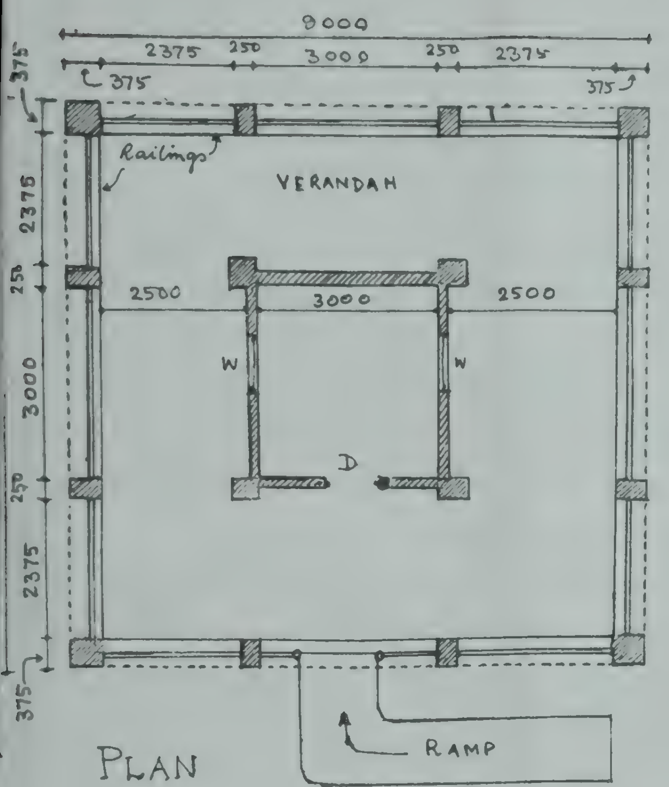


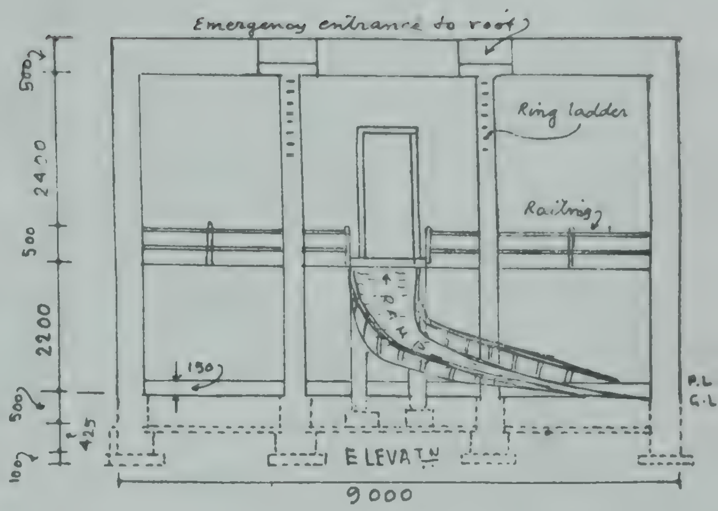




Minimum Sheter in Flood-Prone Areas. (Growing House)


PRECAST RCC ROOF SLAB WEB TYPE WITH SHARP LIPS
SLOPE 6" FROM NORTH TO SOUTH
PARAPET TO HOLD BAMBOO STRUT DURING HIGH FLOOD. (Preferably in Cement mortar 6:1)
RANIGUNJ OR NURIA TILES.
LOCAL WOOD
WINDOW 2'6"×1'6"
LAMINATED WALLINGS
SPLIT BAMBOO RACKS
BAMBOO
SECTION AT AA
DETAILS OF RC RING-SLABS
FLOOD LEVEL + 6FT
NORTH
WEST
TAKING SHELTER IN ROOF WHEN FLOOD LEVEL = + 6FT.
Laminated wallings
Split bamboo high-level racks
Room 12'-0" x 9'-0"
Bamboo
Kitchen 6'x5'
Racks
Precast RC Ribs
PLAN
FEET
FLOOD LEVEL + 12FT
CURRENT
RURAL HUT FOR FLOOD PRONE AREA
19/11/78
L.O. Eastern Regional Cell
NATIONAL BLDS ORGANISATION
GOVT OF INDIA



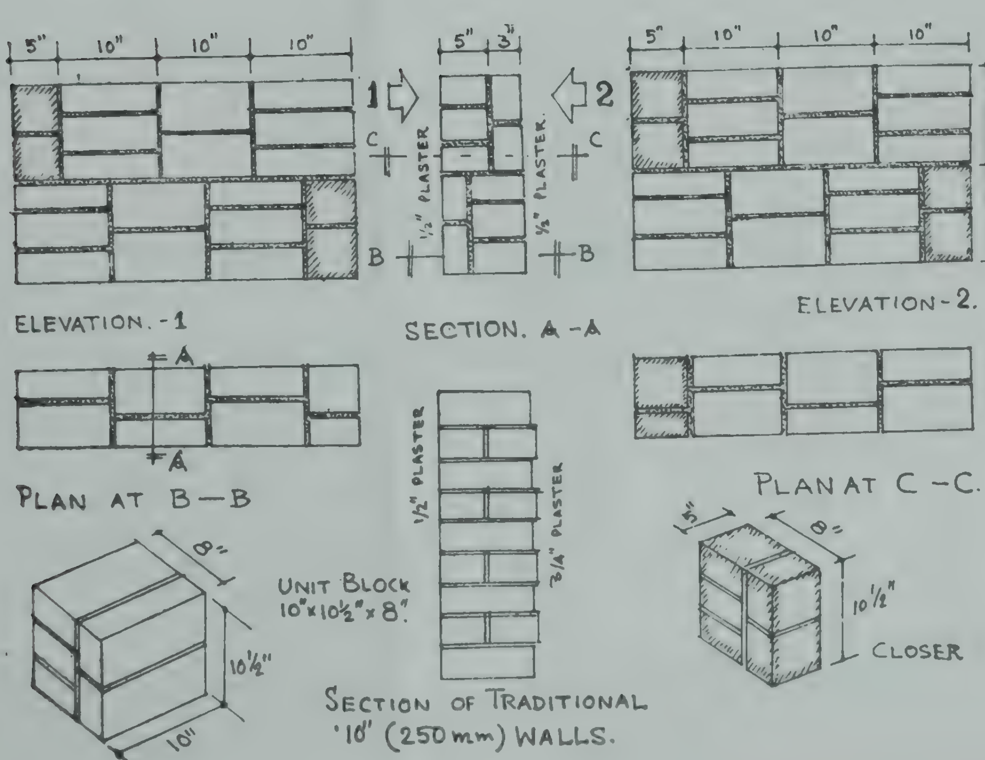


PRIMARY SCHOOL

FOR FLOOD-PRONE AREAS.

13/11/78.

LIAISON OFFICER
EASTERN REGION.
NATIONAL BUILDINGS ORGN.



200 mm walls with normal bricks

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